VIA FEDERAL EXPRESS

July 26, 2005

Mr. J. Robert Brown
Engineering Services, Bureau of Air Quality
2600 Bull Street
Columbia, South Carolina 29201-1708

Re: Bowater Coated and Specialty Papers Division
New Source Review Permit Application

Dear Mr. Brown:

Please find the enclosed two additional copies of the Bowater NSR permit application that was hand delivered today during our meeting. If you need additional copies of the application please do not hesitate to contact me.

Sincerely,

URS Corporation

Steven R. Moore

cc: Mr. Dale Herendeen – Bowater
Ms. Jacquelyn Taylor – Bowater

URS

July 27, 2005

Mr. J. Robert Brown
Engineering Services, Bureau of Air Quality
2600 Bull Street
Columbia, South Carolina 29201-1708

Re: Bowater Coated and Specialty Papers Division
New Source Review Permit Application

Dear Mr. Brown:

Please find the enclosed six copies of revised Table 4.1 (page 14). The revisions include notes added to the bottom of the table for clarification. Please contact Jacque Taylor at (803) 981 – 8759 or me at (864) 527 – 4734 if you have any questions.

Sincerely,

URS Corporation

Steven R. Moore

Steven R. Moore

cc: Mr. Dale Herendeen – Bowater
Ms. Jacquelyn Taylor – Bowater

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Prevention of Significant Deterioration Construction Air Permit Application Kraft Fiberline Optimization

Prepared for

Bowater Coated Paper Division
Catawba, South Carolina

July 2005

URS

Greenville, South Carolina

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1.0 Introduction

Bowater Coated and Specialty Papers Division (Bowater) manufactures coated paper and market pulp at their Catawba, South Carolina facility. In late August 2003, Bowater began operations of a new Fiberline and Bleaching System to comply with the pulp and paper Cluster Rule. The new Fiberline allowed the facility to produce kraft pulp more efficiently and environmentally friendly. This permit application is for modifications to optimize the Fiberline and wood handling systems to produce more kraft pulp for use in higher quality coated paper and market pulp.

The facility plans to also modify the No. 3 recovery furnace and No. 2 lime kiln. The No. 3 recovery furnace modification will increase the black liquor solids burning capacity. The No. 2 lime kiln modification will increase the throughput of lime mud to the kiln.

The South Carolina Department of Health and Environmental Control (SCDHEC) application forms are contained in Appendix A.

2.0 Project Description

The project consists of the following activities:

- modifications to the Fiberline (kraft mill pulping)
- modifications to the wood handling system
- modification of the No. 3 recovery furnace to increase black liquor solids firing
- modification of the No. 1 evaporator set to increase black liquor solids firing
- modification of the No. 2 lime kiln to increase lime mud throughput
- modification of the causticizing area to increase lime mud throughput

2.1 Kraft Mill Pulping and Woodyard Systems

The modifications to the kraft pulping and wood handling systems will consist of the following:

- New truck dump with screening system
- New second primary knotter
- Relocating an existing secondary knotter from the old kraft mill to the Fiberline
- Various pump upgrades

A new truck dump with screening system and conveyor will be installed to meet the increased demand for wood. A new second primary knotter will be installed to increase capacity of the rejects systems at the Fiberline. In addition an existing secondary knotter used in the old kraft mill will be relocated to improve reliability of the pulp screening system. Additional upgrades to pumps and motors will be completed as necessary.

The kraft pulping system is capable of producing approximately 1,675 air dried tons unbleached pulp (ADTUP) per day. The kraft pulping system will produce approximately 1,825 ADTUP per day following the modification. A Fiberline process flow diagram showing the additional screening is contained in Appendix B, as Figure B-1.

The current bleaching system is capable of accommodating the increased production with no physical modifications. The existing kraft bleaching system is currently producing approximately 1,575 air dried tons bleached pulp (ADTBP) per day. The bleaching system will produce approximately 1,752 ADTBP per day after modifications to the Fiberline are completed.

2.2 Kraft Mill Evaporator System

A concentrator will be added to the No. 1 Evaporator System to remove limitations in black liquor evaporation. The concentrator will increase the solids of the black liquor from the No. 1 evaporator set from 48% solids to 68% solids. A new 68% heavy black liquor storage tank will also be constructed. A process flow diagram of the evaporator system is provided as Figure B-2.

2.3 No. 3 Recovery Furnace

This project will increase the black liquor firing capacity of the No. 3 recovery furnace. The maximum black liquor firing rate following the project is expected to be 2,040 tons black liquor solids (BLS) per day. The modifications to the recovery furnace include improving air flow through the furnace with the installation of a fourth level of air and fan upgrades as required. This project will have no effect on natural gas or No. 6 oil firing in the No. 3 recovery furnace.

The No. 3 smelt dissolving tank will in turn process the additional smelt from the No. 3 recovery furnace into additional green liquor. No physical modifications to the No. 3 smelt dissolving tank are required to support this additional processing of No. 3 recovery furnace smelt into green liquor. A process flow diagram showing the planned modifications is contained in Appendix B, as Figure B-3.

2.4 No. 2 Lime Kiln and Causticizing Area

The No. 2 lime kiln will be modified to process the additional cooking chemicals required to support the increased Fiberline production. A lime mud flash dryer will be added to the kiln feed system to pre-dry the lime mud before entry into the kiln. The pre-dryer will recover waste heat

from the kiln flue gas to accomplish the drying. The pre-dryer will not require any additional steam or fuel to operate.

The white liquor filter system will be modified to support the increased production and to provide increased white liquor capacity. The remaining causticizing area equipment (green liquor blend tank, green liquor clarifiers, dregs filter, slaker, causticizers, lime storage silos, lime mud filters, and lime mud washer) will experience additional throughput of green liquor, white liquor, and lime. However, no modifications of this equipment are required to achieve the increased production levels.

Additional equipment including a feed screw conveyor, rotary valve, and new ID fan will be installed to improve the operation of the kiln. The maximum production following the project is expected to be 600 tons of CaO per day. A process flow diagram showing the planned modifications is contained in Appendix B, as Figure B-4.

2.5 Changes to Steam Demand

The proposed project is expected to result in an overall reduction in mill steam demand. The modifications to the No. 3 recovery furnace will increase black liquor solids firing, which will increase steam production. The modifications to evaporator set No. 1 will result in more efficient operation of all three evaporator sets, and decrease steam consumption.

There will be a slight increase in steam consumption from the kraft pulping equipment, but this increase will only consume approximately twenty percent of the overall steam savings from the recovery furnace and evaporator modifications. The reduced overall steam demand is expected to result in burning less fossil fuel in the combination boilers.

3.0 Emissions Estimates

3.1 Kraft Mill Pulping System

The emissions from the pulping system were estimated using industry emission factors. The baseline actual emissions from the pulping system for the previous two years were estimated using the current permitted production rate of 1,675 ADTUP/day, since the equipment has been operating less than two years. This is consistent with the New Source Review Workshop Manual, page A-41. The projected actual emissions from the pulping system were estimated based on the anticipated maximum production rate of 1,825 ADTUP/day, assuming 8,760 hours of operation. The emission calculations for the pulping system are presented in Appendix C.

3.2 Kraft Mill Bleaching System

Although the kraft bleaching system is not being modified, the maximum capacity will increase since all the kraft pulp from the fiberline is processed by the bleaching system. The emissions from the bleaching system were estimated using industry emission factors. The baseline actual emissions from the bleaching system for the previous two years were estimated using the current permitted production rate of 1,575 ADTBP/day, since the equipment has been operating less than two years. This is consistent with the New Source Review Workshop Manual, page A-41. The projected actual emissions from the bleaching system were estimated based on the anticipated maximum production rate of 1,752 ADTBP/day, assuming 8,760 hours of operation. The emission calculations for the bleaching system are presented in Appendix D.

3.3 Kraft Mill Evaporator Set No. 1

The emissions from evaporator set No. 1 were estimated using industry emission factors, and site specific emission factors developed from source testing where appropriate.

The No. 1 evaporator set processes approximately 28 percent of the black liquor produced by the kraft pulping system. The baseline actual emissions from the evaporator set No. 1 for the previous two years were estimated using 28 percent of the current permitted kraft production rate

of 1,675 ADTUP/day, since the kraft pulping system has been operating less than two years (470 ADTUP/day). The projected actual emissions from modified evaporator set No. 1 were estimated based on processing the liquor from the additional 150 ADTUP/day of kraft production (620 ADTUP/day).

The maximum emissions for the new heavy (68%) black liquor storage tank were estimated using industry emission factors. The emission calculations for these systems are presented in Appendix E.

3.4 No. 3 Recovery Furnace and No. 3 Smelt Dissolving Tank

The emissions from the No. 3 recovery furnace (and associated smelt dissolving tank and precipitator mix tank) were estimated using industry emission factors, and site specific emission factors developed from source testing where appropriate.

The baseline actual emissions from the recovery furnace for the previous two years were estimated using the current permitted production rate of 1,774 TLBS/day, since the equipment has been operating less than two years. The projected actual emissions from the modified recovery furnace were estimated based on the anticipated maximum production rate of 2,040 TBLS/day, assuming 8,760 hours of operation.

Although the No. 3 smelt dissolving tank and precipitator mix tank are not being modified, the maximum capacity of these units will increase since all the smelt produced in the recovery furnace is processed by these units. Therefore, baseline actual and projected actual emissions for the smelt tank and precipitator mix tank were also calculated using the current permitted and anticipated maximum production rates for the recovery furnace. The emission calculations for the No. 3 recovery furnace, smelt dissolving tank, and precipitator tank are presented in Appendix F.

3.5 No. 2 Lime Kiln and Causticizing Area

The emissions from the lime kiln and causticizing area equipment were estimated using EPA and industry emission factors, and site specific emission factors developed from source testing where appropriate. The baseline actual emissions from the lime kiln and causticizing area for the previous two years were estimated using the current permitted production rate of 465 tons CaO/day, since the equipment has been operating less than two years. This is consistent with the New Source Review Workshop Manual, page A-41. The projected actual emissions from the modified lime kiln and causticizing area were estimated based on the anticipated maximum production rate of 600 tons CaO/day, assuming 8,760 hours of operation.

The emission calculations for the No. 2 lime kiln and causticizing area equipment are presented in Appendix G.

3.6 Woodyard Truck Dumper

The emissions from the new woodyard truck dumper were estimated using an industry emission factor. There are no past actual emissions for the dumper because this will be new equipment. The potential emissions from the dumper were estimated based on the anticipated maximum capacity of one truck every 15 minutes, at 30 tons per truck. The emission calculations for the woodyard truck dumper are presented in Appendix H.

3.7 Increased Foul Condensate

The modified kraft pulping system and modified evaporator set no. 1 may produce additional foul condensate, which is treated using the condensate steam stripper. The condensate steam stripper has a maximum capacity of 800 gallons per minute, and currently processes approximately 510 gallons per minute. Since the modification to the kraft pulping system and evaporator set No. 1 will increase production approximately fifteen percent, the foul condensate may also increase approximately fifteen percent (to approximately 600 gallons per minute), which is still well below maximum capacity. However, since the condensate steam stripper is

not being modified, and is currently capable of processing the expected increase in foul condensate, the increase in emissions from processing additional foul condensate are excluded as provided for in 61-62.5, Standard No. 7 (b)(41)(ii)(c) and 61-62.5, Standard No. 7.1, (c)(11)(B)(iii).

3.8 Increased Coated Paper and Market Pulp Production

The coated paper machines and market pulp dryer have the capability to process the additional kraft pulp without any modifications. Since production can be increased at any time using purchased fiber (broke, pulp, etc.) from other paper mills, the increase in emissions from additional coated paper/pulp production are excluded as provided for in 61-62.5, Standard No. 7 (b)(41)(ii)(c) and 61-62.5, Standard No. 7.1, (c)(11)(B)(iii).

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4.0 Applicable Regulations

4.1 40 CFR Part 63, Subpart S (National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry)

The Bowater mill is regulated by the Part 63 NESHAPs for the Pulp and Paper Industry (Subpart S). The pulping line is already considered a new source under this regulation and meets all Subpart S requirements. The No. 1 evaporator set is an existing source also regulated under Subpart S.

The MACT standards for kraft pulping and evaporator systems (63.443) allow Bowater to select one of several options for treatment.

- Reduce total HAP emissions by 98 percent or more by weight;
- Reduce total HAP concentration at the outlet of the thermal oxidizer to less than 20 ppm by volume on a dry basis at 10 percent oxygen;
- Reduce total HAP emissions using a thermal oxidizer operating at minimum temperature of 1600°F with a minimum residence time of 0.75 second; or
- Reduce total HAP emissions by introducing HVLC and LVHC gases into the combustion zone of a boiler, lime kiln, or recovery furnace.

In addition, the treatment device used to control HVLC gases (Fiberline) must be operational a minimum of 96 percent of the operating time during the reporting period, excluding periods of startup, shutdown, or malfunction (SSM) (63.443(e)(2)). The LVHC gases (evaporator) are required to be incinerated 99 percent of the operating time, excluding SSM periods. Bowater will combust the LVHC and HVLC gases in the two facility combination boilers.

Monitoring requirements have already been established in accordance with Cluster Rule 63.453(b).

4.2 40 CFR Part 63, Subpart MM (National Emission Standards for Hazardous Air Pollutants from the Pulp and Paper Industry)

The Bowater mill is regulated by the Part 63 NESHAPs for the Pulp and Paper Industry (Subpart MM). This permit application includes modifications to the No. 3 recovery furnace and No. 2 lime kiln.

4.2.1 No. 3 Recovery Furnace

The No. 3 recovery furnace is regulated by 40 CFR Part 63, Subpart MM, which is the portion of the Cluster Rule regulating emissions from kraft mill chemical recovery operations. The MACT regulates emissions of particulate HAP (PM_{HAP}). The MACT floor control for a recovery furnace is an electrostatic precipitator (ESP), which the No. 3 recovery furnace currently has.

The modifications to the No. 3 recovery furnace have an estimated capital cost of approximately eight million dollars. A new recovery furnace has a capital cost in excess of eighty million dollars. Therefore, the modifications are not a reconstruction as defined in 63.2, and the MACT standards for existing sources will apply to the No. 3 recovery furnace following the modification.

The MACT standard for existing recovery furnaces is the NSPS Subpart BB PM standard of 0.044 grains per dry standard cubic foot (gr/dscf), which the No. 3 recovery furnace currently meets. The MACT does not establish gaseous HAP standards for existing recovery furnaces.

4.2.2 No. 2 Lime Kiln

The No. 2 lime kiln is regulated by 40 CFR Part 63, Subpart MM, which is the portion of the Cluster Rule regulating emissions from kraft mill chemical recovery operations. The MACT regulates emissions of PM_{HAP}. The MACT floor control for a lime kiln is an ESP or a wet scrubber. The No. 2 lime kiln has an ESP for particulate control.

The modifications to the No. 2 lime kiln have an estimated capital cost of approximately five million dollars. The No. 2 lime kiln had a capital cost in excess of eighteen million dollars when built in 1994. Therefore, the modifications are not a reconstruction as defined in 63.2, and the MACT standards for existing sources will apply to the No. 2 lime kiln following the modification.

The MACT standard for existing lime kilns is 0.064 gr/dscf, which the No. 2 lime kiln currently meets. The MACT does not establish gaseous HAP standards for existing lime kilns.

4.3 40 CFR Part 60, Subpart BB (Standards of Performance for Kraft Pulp Mills)

4.3.1 Kraft Pulping System

The total reduced sulfur (TRS) emissions from the kraft digesting system are regulated by 40 CFR 60, Subpart BB. The digester system emissions are collected and burned in the combination boilers, meeting the control requirements under 60.283(1)(iii).

The pulp washing system uses a pressure diffusion washer, which is exempted from Subpart BB applicability (60.281(e)). However, the pressure diffusion washer vents to the blow tank, which is included in the digester system definition, so the pulp washing system TRS emissions are controlled.

The evaporator set No. 1 is not regulated under Subpart BB since it was constructed prior to the applicability date. The evaporator set will be modified by adding a sixth evaporator body ("6^{th} effect"). Evaporator set No. 1 currently has five evaporator bodies (5 effects), so adding a sixth evaporator body would be expected to cost less than 20% of the cost of an entire new six effect evaporator set (1/6 of total cost). Therefore, the unit will not meet the NSPS definition of modification and will not become subject to Subpart BB.

The other components of the kraft pulping system (oxygen delignification and knotting and screening systems) are not regulated units under 40 CFR 60, Subpart BB.

4.3.2 No. 3 Recovery Furnace

The No. 3 recovery furnace was constructed in 1982 and is currently subject to NSPS Subpart BB. The NSPS limits for particulate matter and TRS are 0.044 gr/dscf and 5 ppm, respectively. The No. 3 recovery furnace currently meets both emission limits.

4.3.3 No. 2 Lime Kiln

The No. 2 lime kiln was constructed in 1994 and is currently subject to NSPS Subpart BB. The NSPS limits for particulate matter are 0.067 gr/dscf when using gaseous fossil fuel and 0.13 gr/dscf when using liquid fossil fuel. The TRS limit is 8 ppm. The No. 2 lime kiln currently meets all emission limits.

4.4 South Carolina Regulation 62.5, Standard No. 7 (Prevention of Significant Deterioration)

The changes in emissions from the facility as a result of the proposed project were compared to the significant emission thresholds to determine which pollutants would require permitting under the Prevention of Significant Deterioration (PSD) program. The net emission changes were evaluated on a baseline actual-to-projected actual basis for the following sources:

- Kraft mill pulping system
- Kraft mill bleaching system
- No. 1 evaporator set
- No. 3 recovery furnace
- No. 3 smelt dissolving tank
- No. 2 lime kiln
- Causticizing area

The project will increase PM_{10}, SO_2, and NO_X emissions more than the significant levels in Standard No. 7. Because the area is non-attainment for ozone, NO_X emissions are also subject to non attainment NSR (see Section 4.4), which is more restrictive. The project will not have significant increases for CO, VOC, or TRS. A summary of the emission changes and NSR applicability for the project are presented in Table 4.1

4.4 South Carolina Regulation 62.5, Standard No. 7.1 (Non-Attainment)

The Bowater facility is located in the Charlotte/Gastonia/Rock Hill 8-hour Ozone non-attainment area. The changes in NO_X emissions from the facility as a result of the proposed project were compared to the significant emission thresholds to determine which pollutants would require permitting under the non-attainment new source review program. The net emission changes were evaluated on a baseline actual-to-projected actual basis for the following sources:

- No. 3 recovery furnace
- No. 3 smelt dissolving tank
- No. 2 lime kiln

The project will increase NO_X emissions more than the significant levels in Standard No. 7.1; therefore, the project will be subject to non-attainment new source review for ozone (NO_X emissions). The requirements for Standard No. 7.1 include installation of lowest achievable emission rate controls for NO_X and obtaining emission offsets at a ratio of 1.15:1 (1.15 tons of NO_X reductions for every 1 ton NO_X increase).

Bowater will obtain the required NO_X offsets prior to start-up of the modified emission units following completion of the modifications. The project NO_X increase from the project is 127.8 tpy, requiring a NO_X offset of 147 tpy.

Table 4.1
New Source Review Applicability

Emission Unit	PM_{10}	SO_2	NO_X	CO	VOC	TRS
	Baseline Actual Emissions (tpy)					
Kraft Mill Digester Chip Bin	0	-92	0	0	-5.6	0
Kraft Mill Digester and Blow Tank	0	-37	0	0	-2.1	0
Kraft Mill Turpentine Recovery System	0	-0.92	0	0	-0.0056	0
Kraft Mill Pressure Diffusion Washer	0	-22	0	0	-0.79	0
Kraft Mill Knotting and Screening System	0	-26	0	0	-0.9	0
Kraft Mill Oxygen Delignification System	0	-3.5	0	-14	-1.2	0
Kraft Mill Bleaching System	0	0	0	-245	-14	-0.81
Evaporator Set No. 1	0	-141	0	0	-0.83	0
Recovery Furnace No. 3	-192	-71	-486	-405	-29	-6.1
Smelt Dissolving Tank No. 3	-49	-1.6	-6.6	0	-3.2	-4.1
Precipitator Mix Tank No. 3	0	0	0	0	-0.42	-0.035
Causticizing Area	-1.9	0	0	0	-14	-0.3
Lime Kiln No. 2	-27	-28	-180	-11	2.0	-5.3
Total Baseline Actual Emissions	**-269.9**	**-423.0**	**-672.6**	**-675.0**	**-74.0**	**-16.6**
	Projected Actual Emissions (tpy)					
Kraft Mill Digester Chip Bin	0	100	0	0	6.1	0
Kraft Mill Digester and Blow Tank	0	41	0	0	2.3	0
Kraft Mill Turpentine Recovery System	0	1	0	0	0.0061	0
Kraft Mill Pressure Diffusion Washer	0	24	0	0	0.87	0
Kraft Mill Knotting and Screening System	0	28	0	0	1	0
Kraft Mill Oxygen Delignification System	0	3.9	0	15	1.3	0
Kraft Mill Bleaching System	0	0	0	267	15	0.9
Evaporator Set No. 1	0	186	0	0	1.1	0
Recovery Furnace No. 3	221	82	561	464	34	7
Smelt Dissolving Tank No. 3	56	1.9	7.4	0	3.7	4.4
Precipitator Mix Tank No. 3	0	0	0	0	0.48	0.037
Causticizing Area	2.4	0	0	0	18	0.39
Lime Kiln No. 2	34	36	232	14	2.5	7
New 68% Black Liquor Storage Tank	0	0	0	0	0.48*	0.79*
New Woodyard Truck Dumper	1.1*	0	0	0	0	0
Total Projected Actual Emissions	**314.5**	**503.8**	**800.4**	**760.0**	**86.8**	**20.5**
	Project Summary (tons/yr)					
Total for Project	**44.6**	**80.8**	**127.8**	**85.0**	**12.8**	**3.9**
NSR THRESHOLD	**15**	**40**	**40**	**100**	**40**	**10**
IS INCREASE SIGNIFICANT?	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**
	Five-Year Contemporaneous Emissions (tons/yr)					
TMP Bleaching System (CY)	5.7	38.2	15.1	32.5	11.5	0
No. 3 Recovery Furnace (CX)	12.7	14.9	22.3	8	0.9	1.3
Wet End Starch System (CW)	3.6	12	5.8	33	0.77	0
WWTP Holding Basin Pump #1 (CV)	2.5	2.3	35.3	7.6	2.9	0
WWTP Holding Basin Pump #2 (CU)	3.3	3.1	22.7	10.1	3.8	0
TTP Pump A*** (CU)	1.9	1.8	13.1	5.9	2.2	0
ASB Pump A*** (CU)	1.9	1.8	13.1	5.9	2.2	0
New Fiberline & PM3 Conversion (CO, CP, CQ, CR, CS, CT)	N/A**	-217	N/A**	-589	7	-40
LVHC System and Condensate Stripper (CN)	N/A**	196	N/A**	201	-404	2
Air Make-up Units (CM)	N/A**	0	N/A**	27	2	0
Paper Mill Improvement Project (CL)	N/A**	0	N/A**	0	7	0
Condensate Collection Tank (CK)	N/A**	0	N/A**	0	0	0
Total Contemporaneous	**31.6**	**53.1**	**127.3**	**-258.0**	**-363.8**	**-36.7**
Project + Contemporaneous	**76.2**	**133.9**	**255.1**	**-172.4**	**-338.6**	**-33.6**
NSR THRESHOLD	**15**	**40**	**40**	**100**	**40**	**10**
IS INCREASE SIGNIFICANT?	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**

*Potential emissions shown for new sources.
**Construction Permits CO, CP, CQ, CR, CS, and CT were PSD Construction Permits for PM_{10} and NO_X.
***Construction Permit CU included TTP Pump B and ASB Pump B, which have been removed and deleted from Title V Operating Permit.

4.5 South Carolina Regulation 62.5, Standard No. 3 (Waste Combustion and Destruction)

The project is not subject to Standard No. 3, since the combination boilers meet exemption J of Section I - Applicability.

4.6 South Carolina Regulation 62.5, Standard No. 5.1 (State LAER)

The project is not subject to the South Carolina Lowest Achievable Emission Rate (LAER) regulation since VOC emissions increase will not exceed 100 tons since the baseline date.

4.7 South Carolina Regulation 62.5, Standard No. 5.2 (NO_X Control)

The project is not subject to the South Carolina NO_X Control regulation since the recovery furnace and lime kiln are subject to Standards No. 7 and No. 7.1, which are more restrictive.

4.8 South Carolina Regulation 62.5, Standard No. 8 (Air Toxics)

The project is exempt from Standard No. 8 because the Fiberline (digester, washer, knotting and screening, oxygen delignification), evaporator system, No. 3 recovery furnace, and No. 2 lime kiln are all regulated by the pulp and paper MACT Standards (Subparts S and MM).

4.9 South Carolina Regulation 62.70 (Title V)

Bowater will submit revised Title V permit application forms for these sources within one year of startup of the modified equipment. The revised Title V application will address monitoring, recordkeeping, and reporting requirements contained in the pulp and paper MACT standards.

5.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

New Source Review (NSR) regulations [South Carolina Regulations (SC APCR 62.5 Standard No. 7 and 7.1)] require that Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) be applied to minimize the emissions of compounds from a new major source or a major modification of an existing major source in attainment and non-attainment areas, respectively. This section presents the BACT evaluation for PM_{10} and SO_2, and the BACT/LAER evaluation for NO_X from the emission units that are being modified as part of the proposed project. No other pollutants exceed the NSR significance levels as a result of the proposed project.

The kraft mill pulping system, kraft mill bleaching system, No. 3 recovery furnace, No. 2 lime kiln, and evaporator set No. 1 all will be modified and have a net emission increase of at least one PSD compound. However, as the pulping system, bleaching system, and evaporators do not emit PM_{10}, SO_2, or NO_X, BACT/LAER is not addressed for these emission units. BACT/LAER analyses for PM_{10}, SO_2, and NO_X were performed for the No. 3 recovery furnace and No. 2 lime kiln.

Since the application of BACT/LAER is only required for modified units whose emissions of NSR pollutants have a net increase above the NSR significant emission rates, a BACT/LAER analysis was not performed on the No. 3 smelt dissolving tank, condensate steam stripper, and Nos. 1 and 2 combination boilers. The pulping system and evaporators emit TRS gases that are collected in the LVHC and HVLC systems and combusted in the combination boilers. These gases are required by federal regulations (MACT and NSPS) to be collected in the LVHC and HVLC systems, and although the primary purpose of the combination boilers is to produce steam for mill operations, the boilers also combust the LVHC and HVLC gases from the fiberline and evaporators. No modifications are necessary to the LVHC and HVLC systems or the combination boilers to handle the potential increase in LVHC or HVLC gases. Therefore, although there will be an associated increase in SO_2 emissions from the increase in combustion of LVHC and HVLC gases in the combination boilers, BACT is not required for the LVHC and

HVLC systems and the combination boilers, as they are not modified emission units. Bowater already employs a white liquor scrubber to reduce the amount of TRS from the LVHC gases to the combination boilers and has addressed the potential collateral increase in SO_2 emissions from the combination boilers from increased NCG burning through a modeling analysis that demonstrates that the SO_2 emissions are below the NAAQS.

The woodyard truck dumper is a fugitive emission source with particulate emissions less than 1 pound per hour. As such, the installation of control technologies for the woodyard truck dumper is not warranted or cost effective and shall not be discussed further.

Section 5.1 presents an overview of the top-down BACT approach used in this application, and the BACT/LAER analyses for PM_{10}, SO_2, and NO_X from the No. 3 recovery furnace and No. 2 lime kiln are presented in Sections 5.2 and 5.3.

5.1 Top-Down BACT Approach

BACT is defined in the Clean Air Act as *an emissions limit based on the maximum degree of emissions reduction for each pollutant...which the permitting authority determines, on a case by case basis, taking into account energy, environmental, and economic impacts and other costs, is achievable for such facility through the application of production processes and available methods, systems, and techniques*…. Four key aspects of the definition are worthy of notice:

- BACT is an "emissions limit" based on a control technology - not the control technology itself; or, if technological or economic limitations on the application of measurement methodology to an emissions unit would not be feasible, a design, equipment, work practice, operation standard, or combination thereof may be prescribed.
- BACT takes into account various costs associated with implementing pollution controls: economic, environmental (air, water, or solid waste), energy, and other impacts.
- BACT includes and, in fact, focuses on "production processes" along with add-on controls.
- BACT is intended to be a case-by-case evaluation, implying individual case evaluations and decisions, not rigid, pre-set guidelines.

The top-down BACT approach starts with the most stringent (or top) technology that has been applied to the same unit at other similar emission source types and provides a basis for rejecting the technology in favor of the next most stringent technology or proposing it as BACT.

Step 1

The first step is to define the spectrum of process and/or add-on control alternatives potentially applicable to the subject emissions unit. The following categories of technologies are addressed in identifying candidate control alternatives:

- Demonstrated add-on control technologies applied to the same emissions unit at other similar source types;
- Add-on controls not demonstrated for the source category in question but transferred from other source categories with similar emission stream characteristics;
- Process controls such as combustion or alternate production processes;
- Add-on control devices serving multiple emission units in parallel; and
- Equipment or work practices, especially for fugitive or area emission sources where add-on controls are not feasible.

A review of the RACT/BACT/LAER Clearinghouse (RBLC) is the first step in this process.

Step 2

The second step in the top-down approach is to evaluate the technical feasibility of the alternatives identified in the first step and to reject those that can be demonstrated as infeasible based on an engineering evaluation or on chemical or physical principles. The following criteria are considered in determining technical feasibility: previous commercial-scale demonstrations, precedents based on permits, requirements for similar sources, and technology transfer.

Step 3

The third step is an assessment and documentation of the emissions limit achievable with each technically feasible alternative considering the specific operating constraints of the emission units undergoing review. After determining what control efficiency is achievable with each alternative, the alternatives are rank-ordered into a control hierarchy from most to least stringent.

Step 4

The fourth step is to evaluate the cost/economic, environmental, and energy impacts of the top or most stringent alternative. To reject the top alternative, it must be demonstrated that this control

alternative is infeasible based on the impacts analysis results. If a control technology is determined to be technically infeasible or infeasible based on high cost effectiveness, or to cause adverse energy or environmental impacts, the control technology is rejected as BACT and the impact analysis is performed on the next most stringent control alternative. In analyzing economic cost effectiveness, the annualized control cost (in dollars per ton of emissions removed) was compared with commonly accepted values for cost effective emission controls.

Step 5

The fifth and final step in the analysis is the consideration of toxic pollutant impacts on the control alternative choice. Toxics concerns are usually important only if an adverse toxic emissions impact results from the selected alternative. As in step 4, if an adverse toxic emissions impact is determined, the alternative is rejected in favor of the next most stringent alternative.

5.2 No. 3 Recovery Furnace

The No. 3 recovery furnace was built in 1982 and received a PSD construction permit which included BACT emission limits for PM_{10}, SO_2, NO_X, and CO. In 2001, the No. 3 Recovery Furnace underwent modifications, as part of the Fiberline project that resulted in new BACT emission limits for PM_{10}, SO_2, and NO_X.

The No. 3 recovery furnace will have a net increase in emissions of CO, PM_{10}, SO_2, NO_X, VOC, and TRS. VOC, CO, and TRS emissions increases for the proposed project do not exceed the,PSD significant emission rates, so BACT is not required for these compounds. The Charlotte-Gastonia-Rock Hill, NC-SC area was designated a nonattainment area for ozone on June 15, 2004. Based upon the non-attainment status for ozone, Bowater must perform a LAER analysis for NO_x emissions, while BACT must be addressed for PM_{10}, and SO_2.

5.2.1 Sulfur Dioxide

The net increase in sulfur dioxide (SO_2) emissions from the modification to No. 3 recovery furnace is the result of the increased firing of black liquor solids through the system. SO_2 emissions from firing black liquor solids in a recovery furnace are typically low due to an

extremely large recovery of sulfur as sodium sulfide in the smelt and capture of alkali sulfates in the particulate control device. When black liquor is burned in a recovery furnace, sulfur gases in the form of both SO_2 and reduced sulfur compounds (TRS) are released. As air is added to the secondary and tertiary air ports of the recovery furnace, TRS gases are oxidized to SO_2. Sulfur dioxide emissions from recovery furnaces are variable from furnace to furnace and depend on several key parameters, including properties of the black liquor solids (i.e., sulfur to sodium ratio, chloride content, black liquor solids concentration), properties of the combustion air (i.e., air distribution, percent excess oxygen, air moisture content), furnace loading, and liquor spray pattern.

5.2.1.1 Demonstrated Control Technologies

Bowater has evaluated control technologies for sulfur dioxide emissions from No. 3 recovery furnace through the review of the RBLC database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets.

The RBLC contains multiple SO_2 determinations for modifications to existing recovery boilers. BACT determinations for new equipment or sources were excluded from further evaluation. A summary of the BACT determinations for recovery furnaces is contained in Table 5.1.

Table 5.1
Summary of SO_2 RBLC Determinations
Existing Recovery Furnaces

RBLCID	FACILITY	COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
AL-0016	MACMILLAN BLOEDAL	WILCOX	AL	2339	TONS/YEAR	BOILER DESIGN
AL-0015	HAMMERMILL PAPER	DALLAS	AL	1,901	TPY	BOILER DESIGN AND GOOD COMBUSTION PRACTICES
AL-0015	HAMMERMILL PAPER	DALLAS	AL	272	LB/HR	NONE
AL-0018	ALABAMA RIVER PULP COMPANY		AL	NONE LISTED		NONE
AL-0019	UNION CAMP CORPORATION		AL	NONE LISTED		NONE
AL-0039	MEAD COATED BOARD, INC.	RUSSELL	AL	144 404	PPM LB/HR	NONE
AL-0097	MEAD COATED BOARD, INC.	PHENIX CITY	AL	144 243	PPMDV @ 8% O_2 LB/HR	BOILER DESIGN AND COMBUSTION CONTROL

Table 5.1
Summary of SO_2 RBLC Determinations
Existing Recovery Furnaces

RBLCID	FACILITY	COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
AR-0013	NEKOOSA PAPER COMPANY		AR	250	PPM	NONE
CA-0032A	SARA LEE PAPER COMPANY		CA	NONE LISTED		NONE
CA-0278	LOUISIANA PACIFIC CORP.	SAMOA	CA	50	PPM @8%0_2	HIGH SOLIDS FIRING
FL-0035	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	150 244	PPM LB/HR	NONE
GA-0028	GREAT SOUTHERN PAPER	CEDAR SPRINGS	GA	300 535	PPMVD @ 8% O_2 LB/HR	SEE NOTE #2
ID-0003	POTLATCH CORPORATION	LEWISTON	ID	200 400	PPM LB/HR	NONE
KY-0039A	WILLAMETTE INDUSTRIES, INC.	HANCOCK	KY	100	PPM @8%0_2	NONE
KY-0067	WILLAMETTE INDUSTRIES, INC.	HANCOCK	KY	200 225.2	PPMV @ 8%O_2 LB/HR	PROPER COMBUSTION CONTROL
KY-0085	MEADWESTVACO WICKLIFFE	BALLARD	KY	0.29	LB/ADTP (PSD net out limt)	WET SCRUBBER
LA-0122	INTERNATIONAL PAPER MANSFIELD MILL	DE SOTO PARISH	LA	510	LB/HR	GOOD PROCESS CONTROLS
LA-0174	GEORGIA-PACIFIC CORPORATION PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	120 105.91 143.23	PPMV @ 8%O_2 LB/HR LB/HR	NONE
ME-0030	LINCOLN PULP AND PAPER CO., INC.	PENOBSCOT	ME	100 149.7	PPMV @8% O_2 LB/HR	BOILER OPERATION & SULFUR CONTENT OF FUEL
MS-0005	WEYERHAEUSER CO.	LOWNDES	MS	100	PPM	EQUIPMENT OPERATION
MS-0008	LEAF RIVER PRODUCTS	PERRY	MS	300 458	PPM LB/HR	FUEL SPEC
MS-0015	WEYERHAEUSER CO.	COLUMBUS	MS	200 517.3	PPMVD AT 4% O_2 LB/HR	PROCESS CONTROLS
MS-0022	LEAF RIVER FOREST PRODUCTS	NEW AUGUSTA	MS	300	PPM AT 8% O_2	COMPUTER OPERATED COMBUSTION CONTROL
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	220	PPMVD @ 4% O_2	FURNACE DESIGN AND EFFICIENT OPERATION
NC-0089	CHAMPION INTERNATIONAL CORPORATION ROANOKE RAPIDS MILL	HALIFAX	NC	75 571	PPMVD @ 8% O_2 TONS/YEAR	FURNACE DESIGN AND COMBUSTION OPTIMIZATION
NC-0092	INTERNATIONAL PAPER RIEGELWOOD MILL	COLUMBUS	NC	979.2	LB/HR	GOOD COMBUSTION PRACTICE
SC-0003	WESTVACO CORPORATION	CHARLESTON	SC	300	PPM	30% SULFIDITY
SC-0013	BOWATER CAROLINA	YORK	SC	300	PPM	NONE
SC-0014	UNION CAMP CORP.	RICHLAND	SC	230	PPMV	NONE
SC-0015	WILLAMETTE INDUSTRIES MARLBORO MILL	MARLBORO	SC	200	PPM	LOW ODOR DESIGN
SC-0016	UNION CAMP CORP.	RICHLAND	SC	200	PPMV @ 8%O2	BOILER DESIGN AND COMBUSTION CONTROL
SC-0045	WILLAMETTE INDUSTRIES MARLBORO MILL	MARLBORO	SC	75 185.7	PPMV LB/HR	GOOD COMBUSTION CONTROL
SC-0083	WEYERHAUSER COMPANY	MARLBORO	SC	75 838	PPMV@ 8% O_2 TPY	COMBUSTION CONTROL
TN-0126	TENNECO PACKAGING	COUNCE	TN	110	PPMVD @8%O_2	

Table 5.1
Summary of SO_2 RBLC Determinations
Existing Recovery Furnaces

RBLCID	FACILITY	COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
TX-0071	KIRBY FOREST INDUSTRIES	NEWTON	TX	434 0.46	LB/HR LB/MM BTU	NONE
TX-0263	DONAHUE INDUSTRIES, INC.	ANGELINE	TX	206 250	LB/HR PPMV	NONE
VA-0173	CHESAPEAKE CORPORATION	CHESAPEAKE	VA	145 1284	PPMV@ 8% O_2 TPY	FURENACE DESIGN AND OPERATION
WA-0002	LONGVIEW FIBRE COOMPANY	OLYMPIA	WA	120	PPMDV AT 8% O_2	BOILER DESIGN AND GOOD COMBUSTION PRACTICES
WA-0022	JAMES RIVER COMPANY	CAMUS	WA	10 46.2	PPMDV AT 8% O_2 TPY	HEAT RECOVERY SCRUBBER
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	60	PPMDV AT 8% O_2	NONE
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	120	PPMDV AT 8% O_2	NONE
WI-0141	MOSINEE PAPER CORP	MARATHON	WI	209.8	TPY	NONE
WI-0208	DOMTAR NEKOOSA MILL	NEKOOSA	WI	60	PPMVD @8% O_2	GOOD OPERATING PRACTICES
2004 BACT	INTERNATIONAL PAPER	ROANOKE RAPIDS	NC	75 110	PPM @8% O_2 (ANNUAL) , 571 TPY PPM@8%O_2 (3-HR)	FURNACE DESIGN AND COMBUSTION OPTIMIZATION

The selected control technologies for existing recovery boilers include boiler design, combustion practices, fuel controls, a wet scrubber, and a heat recovery scrubber. As indicated in Table 5.1, the James River Company facility utilizes a heat recovery scrubber for SO_2 control. According to the Washington Department of Ecology, the heat recovery scrubber was installed at the facility for heat recovery purposes, although the unit does achieve some SO_2 control. The James River Company performed modifications to two existing recovery boilers at the hardwood and softwood mill in Camas, Washington. According to Mr. Teddy Le of the Washington Department of Ecology, the James River facility designed the recovery furnaces with heat exchangers to capture energy from the recovery boiler flue gases. As part of the heat exchange system, the facility constructed a caustic scrubber system to protect the heat exchanger. The scrubber's primary purpose is not to control SO_2 emissions from the recovery furnace. Mr. Le stated the scrubber was designed to have an SO_2 control efficiency of 98 percent. The SO_2 limit for the facility (10 ppmv) is based upon a 500 ppm SO_2 emission limit and a control efficiency of 98 percent.

The range of SO_2 emission limits for existing furnaces that have been modified is 10 to 300 ppm, with an average of 162 ppm and a median of 145 ppm. The most recent determinations (from the year 2004) are 60 ppm for a recovery furnace in Wisconsin and 75 ppm for a recovery furnace in North Carolina. The two most recent BACT determinations for SO_2 from recovery furnaces in South Carolina are 75 ppm.

The most stringent emission limit for SO_2 in the RBLC is associated with the Mead Westvaco facility in Wickliffe, Kentucky. In 2002, Mead Westvaco modified an existing recovery furnace to handle increased plant production. According to Mr. Tom Adams of the Kentucky Department of Environmental Protection, the emission rate reported in the RBLC Clearinghouse (0.29 pounds/ air dried ton of pulp) was not established as BACT. Rather, the limit reported in the RBLC represents the results of a netting analysis to avoid PSD review for SO_2. Because this determination in the clearinghouse does not represent a BACT limit, the BACT determination for Mead Westvaco has been eliminated from further consideration in this BACT analysis.

5.2.1.2 Potential Control Technologies

Emission control technologies potentially applicable for the removal or destruction of sulfur dioxide from an air stream were initially evaluated based upon technical feasibility. Technologies determined to be technically infeasible were excluded from further evaluation. The technologies evaluated for control of SO2 emissions from black liquor solids firing were wet scrubbers and good combustion practices.

5.2.1.2.1 Wet Scrubbers

A wet scrubber removes gaseous contaminants from a gas stream through intimate contact with suitable absorbing or wetting liquor, such as caustic. Packed bed scrubbers were not considered for this application due to the high exhaust flow rate.

Based upon review of the RBLC and contact with state agencies, scrubbers have been employed as a pollution control device for SO_2 emissions from recovery

boilers at kraft pulp mills in only a few situations. Wet scrubbers are more typically used on large fossil fuel fired utility boilers with much higher outlet SO_2 concentrations. Wet scrubbers utilized on utility boilers have a control efficiency averaging 90 percent (EPA -452/F-03-012).

5.2.1.2.2 Good Combustion Practices

The RBLC search indicates that proper furnace design and good combustion practices are the primary control technologies used within the pulp and paper industry for control of SO_2 emissions from recovery furnaces during black liquor solids combustion. As previously mentioned, SO_2 emissions from firing black liquor solids in a recovery furnace are typically low due to an extremely large recovery of sulfur as sodium sulfide in the smelt and capture of alkali sulfates in the particulate control device.

5.2.1.3 Control Technology Cost Estimates

Control costs have been evaluated for wet scrubber control of sulfur dioxide from the No. 3 recovery furnace. The cost-effectiveness was determined by dividing the incremental annual cost difference by the theoretical SO_2 emissions reduction in tons per year for the control option.

The capital costs for the installation of a wet scrubbing system were determined using the formulas provided in Section 6.2 of the EPA Air Pollution Control Cost Manual, Sixth Edition (APCCM). Basic equipment costs for a wet scrubber system is based on the air flow and pollutant loading. Ancillary equipment costs were determined based on the APCCM guidance document. The purchased equipment cost includes the equipment costs plus additional costs associated with instruments and controls, taxes, and freight. These additional costs are typically estimated at eighteen percent of the equipment costs. The total capital investment for the wet scrubber system is estimated based on a series of factors applied to the purchased equipment cost

to obtain direct and indirect installation costs. These costs are then added to the purchased equipment cost to determine the total capital investment.

Pulp production losses have also been considered in the capital cost section of the cost analysis. For the plant to install the scrubber system, the recovery furnace and the associated pulp production process must be shutdown for a period of time. The plant typically schedules 5 days of downtime for maintenance and repair of the No. 3 recovery furnace each year. It is assumed that these 5 days could be used within the shutdown period required to allow for the necessary construction and installation efforts. Due to the difficulty associated with installation of new equipment and controls, it is estimated that the effort would take 10 days to complete. Beyond the 5 days of scheduled downtime, the plant will have pulp production losses for 5 days. The Catawba plant produces approximately 1,675 tons of bleached kraft pulp per day. The No. 3 recovery furnace processes approximately sixty percent of the black liquor solids generated from the kraft pulp mill. Therefore, approximately 1,005 tons of bleached kraft pulp production will be lost each day the No. 3 recovery furnace is shutdown.

The methodology used to determine the monetary amount associated with these losses was found in Section 6.1.1.1 of U.S. EPA's Technical Document for Chemical Recovery Combustion Sources at Kraft and Soda Pulp Mills. This document assumes that kraft mills achieve an earnings margin of 25 percent; and subsequently, the value of the lost pulp production is estimated to be equal to approximately 25 percent of the total market value. The market value for bleached pulp listed in this document is $646 per air-dried ton of pulp in 1991 dollars. Using the VAPCCI index and the Bureau of Labor Adjustment factor, this market value was escalated to $1,167 per air-dried ton of pulp in 2005 dollars. This cost associated with production losses will be added to the total capital investment when determining the annualized capital recovery cost.

Direct annual costs include operating and supervisory labor, operating materials, replacement parts, maintenance labor and materials, electricity, and dust disposal. Typical labor rates and material cost determinations have been determined based on APCCM assumptions for venturi

scrubbers (the acid gas control section of the APCCM only addressed packed tower absorbers). APCCM states that typical operating labor requirements are 2 to 8 hours per shift for each scrubber system and the supervisory labor is assumed to be fifteen percent of operating labor. The example in the APCCM uses 3 hours per shift and $20/hr. Maintenance labor is estimated at 1 hour per shift at a rate of $20/hr.

The electricity price of $0.046 per kilowatt-hour was used in the electricity cost determinations. The annual cost of electricity is based on the inlet stream flow rate, pressure drop, and pump/blower size. This cost was determined using the formula found in the APCCM. The scrubber system will also have water, scrubbing solution, wastewater treatment, and waste disposal costs. These costs have been determined using the formulas found in the APCCM.

Indirect annual costs have been determined for the scrubber system. These indirect costs include overhead, taxes, insurance, administrative costs, and capital recovery. Overhead costs are assumed to be 60% of operating and maintenance costs, as presented by APCCM. Taxes, insurance, and administrative costs are assumed to be four percent of the total capital investment, not including pulp production losses. Capital recovery is determined using a factor based on an equipment life of 15 years and an interest rate of ten percent. Per the 1990 OAQPS Control Cost Manual, the interest rate used in the cost calculations is a pretax marginal rate of return on private investment, or a "real private rate of return." Most manufacturers expect a rate-of-return on capital expenditures of ten percent or higher. This factor is then multiplied by the total capital investment, including pulp production losses.

This cost effectiveness of installing a SO_2 scrubber is based upon the annualized costs divided by the emissions reduction provided by the control technology. A vendor-prepared cost estimate for a wet scrubbing system was approximately $4,000,000 dollars per unit, which includes the control system design, stack design, and erection costs. Items not included within the estimate are electrical wiring, control systems, reagent storage/feed systems, utility connections, site preparations, footings/supports, and ducting to the scrubber system.

In order to achieve control of SO_2 emissions, the cost estimate is for a single scrubber post-ESP on the No. 3 recovery furnace. Using APCCM formulas, the total capital investment for the scrubber system has been estimated at $7,720,000 without pulp losses. When accounting for annual costs and capital recovery factors, the total annualized cost for the SO_2 controls is $3,457,703. Based on the estimated future actual emissions from the No. 3 recovery furnace of 82 tpy and a 90% SO_2 reduction, the annualized cost of a wet scrubber on No. 3 recovery furnace is $46,879 per ton of SO_2 removed. An SO_2 reduction higher than 90 percent is not expected due to the relatively low inlet SO_2 loading to the scrubber. At $46,879/ton SO_2 removed, control of SO_2 emissions from the No. 3 recovery furnace using a wet scrubber is not cost effective.

Based on a recovery furnace emission rate of 50 ppm and a reduction in SO_2 of 90 percent, the annualized cost of a wet scrubber is $6,913/ton SO_2 removed. Although typical recovery boiler emissions should be below 50 ppm on a long term average basis, worst case emissions from the unit may reach these levels on a short term basis for limited periods.

To facilitate to removal of SO_2 from the recovery boiler No. 3 flue gases, the wet scrubber would require substantial space, estimated at 250 square feet. Bowater has limited space in the powerhouse area of the Catawba Mill. To site a wet scrubber alongside recovery boiler No. 3, Bowater would have to perform demolition and construction activities to create the necessary space. The existing turpentine recovery system would have to be relocated and LVHC system modified. The old kraft mill would have to undergo asbestos abatement and demolition activities. The access drive between the old kraft mill and the powerhouse and existing rail spur, including associated utility and sewer lines, would have to be relocated to the area currently containing the old pulp mill. Once the infrastructure was relocated, the costs as specified above would be applicable. Because Bowater feels the technology is not cost effective at $46,879/ton SO_2 removed, these additional site construction costs have not been evaluated or included in the estimate.

5.2.1.4 Selection of BACT

Upon review of available SO_2 control technologies, a wet scrubber system was the sole add-on control technology determined to be technically feasible for controlling SO_2 emissions from recovery furnaces. A cost analysis has demonstrated that a wet scrubber is not a cost effective means of controlling SO_2 emissions from the No. 3 recovery furnace. BACT is the proper design and operation of the No. 3 recovery furnace. Based upon vendor information regarding SO_2 emissions and historical emissions and operating data, Bowater requests an SO_2 limit of 50 ppmv at 8% oxygen (24-hour average). This represents the lowest SO_2 emission rate listed within the RBLC database without the use of a wet scrubber.

5.2.2 Nitrogen Oxides (NO_X)

Nitrogen oxides (NO_x) are formed from the reaction of nitrogen (N_2) and oxygen (O_2) within the combustion air thus creating thermal NO_x. Increased quantities of oxygen in the combustion zone results in greater amounts of NO_x formation. Once formed, the decomposition of NO_x at lower temperatures, although thermodynamically favorable, is kinetically limited. Thus, NO_x control strategies are based upon reducing formation of NO_x within the combustion zone by reducing the combustion temperature, oxygen concentration in the high temperature combustion zone, and the gas residence time at high temperatures.

Based upon the firing temperature and the staged combustion methodologies inherent to a recovery boiler, NO_x emissions are largely based on the nitrogen content of the black liquor solids. Thermal NO_x formation is dependant on elevated temperatures (>2,800^{o}F). NO_x control for recovery boilers that minimize combustion temperatures through changes in temperature, pressure, burner design, etc. will result in minimal control efficiency. Although NO_x emissions from recovery furnaces are dependant upon the nitrogen content of the black liquor, the technology is unavailable to limit nitrogen present in the raw material feedstock or resulting black liquor. The low NO_x nature of a recovery furnace results in control technologies achieving between 10 and 20 percent total reduction in emissions.

Based upon the attainment status of the region, this BACT analysis includes a LAER analysis.

5.2.2.1 Demonstrated Control Technologies

Bowater evaluated control technologies for NO_X emissions from kraft recovery furnaces through the review of the RBLC database, the EPA NEET Clean Air Technologies Database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets. New or unbuilt recovery furnaces were excluded from further review. A summary of the BACT/LAER determinations for existing recovery furnaces is contained in Table 5.2.

Table 5.2
Summary of NO_x RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
AL-0002	SCOTT PAPER	MOBILE	AL	242	LB/HR	EQUIPMENT OPERATION
AL-0015	HAMMERMILL PAPER	DALLAS	AL	114.2	LB/HR	BOILER DESIGN & COMBUSTION CONTROL
AL-0020	INDEPENDENT KRAFT CORPORATION		AL	31.8	LB/HR	NONE
AL-0039	MEAD COATED BOARD	RUSSELL	AL	112	PPMDV @ 8% O_2	NONE
AL-0053	JAMES RIVER PENNINGTON	CHOCTAW	AL	115	PPMV AT 8% O_2	COMBUSTION CONTROLS
AL-0097	MEAD COATED BOARD, INC.	PHENIX CITY	AL	112	PPMDV @ 8% O_2	COMBUSTION CONTROLS
AR-0027	POTLATCH CORPORATION- CYPRESS BEND MILL	MCGEHEE	AR	110	PPMDV	PROPER DESIGN AND OPERATION
CA-0278	LOUISIANA-PACIFIC CORPORATION	SAMOA	CA	0.1	LB/HR	BOILER DESIGN
CA-0866	LOUISIANA-PACIFIC SAMOA, INC.	SAMOA	CA	78	PPM AT 8% O_2 (12 H)	LOW NOX BURNERS FOR NATURAL GAS COMBUSTION
FL-0035	GEORGIA-PACIFIC CORPORATION	PALATKA	FL		Not listed	PROPER EQUIPMENT OPERATION
FL-0058	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	100	PPMVD AT 8% O_2	COMBUSTION CONTROL
FL-0099	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	80	PPMVD AT 8% O_2	COMBUSTION MODIFICATION COMBUSTION CONTROL TECHNOLOGY
GA-0028	GREAT SOUTHERN PAPER	CEDAR SPRINGS	GA	154	LB/H	NONE
ID-0003	POTLATCH CORPORATION	LEWISTON	ID	321	LB/HR	NONE
ID-0006	POTLATCH CORPORATION	LEWISTON	ID	160	LB/H	NONE
LA-0122	INTERNATIONAL PAPER – MANSFIELD MILL	DESOTO PARISH	LA	147.8	LB/HR	GOOD PROCESS CONTROLS
LA-0174	GEORGIA-PACIFIC CORPORATION	EAST BATON ROUGE	LA	142.01	LB/HR	STAGED COMBUSTION, GOOD COMBUTION PRACTICES
LA-0174	GEORGIA-PACIFIC CORPORATION	EAST BATON ROUGE	LA	192.06	LB/HR	STAGED COMBUSTION, GOOD COMBUTION PRACTICES
ME-0030	LINCOLN PULP AND PAPER COMPANY	PENOBSCOT	ME	200	PPMV @8% O_2	PROPER BOILER OPERATION

Table 5.2
Summary of NO_x RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
MN-0015	BOISE CASCADE		MN	80	PPM AT 8% O_2	COMBUSTION CONTROL
MS-0005	WEYERHAUSER CO.	LOWNDES	MS	70	PPM	EQUIPMENT OPERATION
MS-0015	WEYERHAEUSER CO.	COLUMBUS	MS	70	PPMVD AT 4% O_2	PROCESS CONTROLS
MS-0018	LEAF RIVER FOREST PRODUCTS	NEW AUGUSTA	MS	80	PPM AT 8% O_2	COMPUTER OPERATED COMBUSTION CONTROL
MS-0022	LEAF RIVER FOREST PRODUCTS	NEW AUGUSTA	MS	110	PPM AT 8% O_2	COMPUTER OPERATED COMBUSTION CONTROL
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	80	PPMVD @ 8% O_2	STAGED COMBUSTION
NC-0089	INTERNATIONAL PAPER	ROANOKE RAPIDS	NC	110	PPMV AT 8% O_2	FURNACE DESIGN AND COMBUSTION CONTROL
NC-0092	INTERNATIONAL PAPER	RIEGELWOOD	NC	586.5	LB/HR	GOOD COMBUSTION PRACTICE
NH-0006	GROVETON PAPERBOARD	GROVETON	NH	0.85	LB/TBLS	NONE
PA-0145	INTERNATIONAL PAPER COMPANY	ERIE	PA	0.2	LB/ MM BTU	NONE
SC-0003	WESTVACO CORPORATION	CHARLESTON	SC	0.25	LB/MM BTU	BOILER DESIGN
SC-0014	UNION CAMP CO.	RICHLAND	SC	210	PPMVD	NONE
SC-0015	WILLAMETTE INDUSTRIES	MARLBORO	SC	150	PPMVD	BOILER DESIGN AND GOOD COMBUSTION
SC-0016	UNION CAMP PULP AND PAPER MILL	RICHLAND	SC	150	PPMVD	BOILER DESIGN AND GOOD COMBUSTION
SC-0016	UNION CAMP PULP AND PAPER MILL	RICHLAND	SC	200	PPMVD	BOILER DESIGN AND GOOD COMBUSTION
SC-0045	WILLAMETTE INDUSTRIES	MARLBORO	SC	100	PPMVD	GOOD COMBUSTION CONTROL
SC-0083	WEYERHAUSER CORPORATION	MARLBORO	SC	100	PPMV AT 8% O_2	4^{TH} LEVEL OF AIR, STAGED COMBUSTION
SC-0084	BOWATER	YORK	SC	80	PPMV AT 8% O_2	GOOD COMBUSTION CONTROL
TN-0126	TENNECO PACKAGING	COUNCE	TN	110	PPMVD @8% O_2	COMBUSTION CONTROL AND GOOD OPERATING/ENGINEERING PRACTICES
TX-0263	DONAHUE INDUSTRIES	ANGELINE	TX	55	LB/HR	NONE
VA-0173	CHESAPEAKE CORP.	CHESAPEAKE	VA	112	PPMDV AT 8% O_2	FURNACE DESIGN & OPERATION
WA-0002	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	95	PPMV AT 8% O2	BOILER DESIGN AND GOOD COMBUSTION
WA-0022	JAMES RIVER CORPORATION	CAMAS	WA	2.13	LB/ADUT	DEISGN AND OPERATION
WA-0022	JAMES RIVER CORPORATION	CAMAS	WA	2.44	LB/ADUT	DEISGN AND OPERATION
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	95	PPMV AT 8% O_2	GOOD COMBUSTION PRACTICES
WI-0141	MOSINEE PAPER CORPORATION	MARATHON	WI	95	PPMV AT 8% O_2	GOOD COMBUSTION
WI-0208	DOMTAR NEKOOSA MILL	NEKOOSA	WI	90	PPMVD AT 8% O_2	GOOD COMBUSTION CONTROL
2004 BACT	INTERNATIONAL PAPER	ROANOKE RAPIDS	NC	100	PPMVD @8%O_2	FURNACE DESIGN AND COMBUSTION OPTIMIZATION
2004 BACT	INTERNATIONAL PAPER	RIEGELWOOD	NC	100	PPMVD @8%O_2	FURNACE DESIGN AND COMBUSTION OPTIMIZATION

Of the previous BACT/LAER determinations listed in the RBLC database for existing recovery furnaces and two additional recent BACT determinations in North Carolina not listed in the

RBLC, the selected pollution control measures included good combustion practices, low NO_x burners (natural gas firing only), and staged combustion. Since emission limits that are established on a pound per hour or ton per year basis are applicable to the individual site and operating conditions, Bowater has not evaluated limits against the proposed modification.

The lowest emission limit in the RBLC is 78 ppmv (12-hour average) and there are several facilities that have received 80 ppmv. In 1990, the Louisiana-Pacific Samoa, Inc. (L-P Samoa) facility in Samoa, California added a new recovery furnace to replace two existing recovery furnaces. The recovery furnace expansion project was not permitted under PSD as a result of estimated emissions. As a result of stack testing performed in 1990, NO_X and SO_2 emissions from this project were determined to be greater than the PSD threshold values. A subsequent source test in 1992 indicated that L-P Samoa's efforts to reduce emissions resulted lower emissions than the 1990 test. EPA required L-P Samoa to obtain a PSD permit for the 1990 project as a result of a Consent Decree entered in 1996. Following the enforcement action, the recovery boiler at the Samoa, California facility utilized an electrostatic precipitator (PM control), low NO_X burners for natural gas combustion, and a wet scrubber (SO_2 control). The BACT emission rate for this facility was established based upon vendor certification of the retrofitted low NO_X natural gas burner system. In 1999, BACT for NO_X emissions was established at 78 ppm NO_X by volume at 8% oxygen. Since the NO_X emissions limits for this facility are based upon natural gas-firing rather than fuel oil, the L-P Samoa, Inc. determination has been eliminated from consideration as BACT/LAER in this analysis.

Weyerhaeuser Company's (Weyerhaeuser) Columbus, Lowndes County, Mississippi plant is listed three times within the BACT Clearinghouse with different NO_X emission limits. In 1989, Weyerhaeuser modified an existing recovery furnace to handle increased plant production. According to Celina Summerall and Maya Rao of MDEQ, the original BACT NO_X emission rate was established at 70 ppm. The BACT NO_X emission rate was modified to 70 ppm by volume at 4% oxygen. In 1996, Weyerhaeuser underwent BACT analysis to increase the pulp production of the entire mill. As a result of this project, the NO_X emission rate has increased to

80 ppm by volume at 8% oxygen. Weyerhauser has demonstrated compliance with the 80 ppmv NO_x emission limit.

5.2.2.2 Potential Control Technologies

Emission control technologies potentially applicable for the removal or destruction of NO_x from the post-control air stream were evaluated for technical feasibility. Technologies determined to be technically infeasible were excluded from further evaluation. Control technologies evaluated, as discussed below, included low NO_x burners/air staging, flue gas recirculation (FGR), oxidation/reduction scrubbing (O/R), selective non-catalytic reduction (SNCR), selective catalytic reduction (SCR), non-selective catalytic reduction (NSCR), and good boiler design and operation.

5.2.2.2.1 Low NO_X Burners (LNB)/Air Staging

Combustion within a traditional boiler is facilitated by the introduction of both fuel (natural gas, fuel oil, wood, etc.) into a combustion zone where large volumes of air are combined with the fuel to obtain an optimal flame. As a result of the high air ratio within the combustion zone, flame temperatures increase as well as the formation of NO_x. Low NO_x burners (LNB) or air staging operations facilitate a reduction in NO_x formation by staging the combustion process in a fuel-rich environment without excess air which results in a reduction in peak flame temperatures and the available oxygen for NO_x formation. Combustion is not complete within the first stage of the system. Within the second stage or successive stages, excess air is introduced to complete combustion at lower temperatures.

Low NO_x burner systems are widely utilized for utility boilers and industrial furnaces, while air staging is inherent to the operation of a recovery boiler. Recovery boilers operate by dispensing black liquor into the drying zone thereby removing residual water and initiating combustion of the organics in the stream.

As the gases enter a second or third zone of the combustion chamber more air is introduced to complete combustion and maintain lower combustion temperatures. In the event that temperatures become too elevated, the salts and chemicals recovered at the bottom of the boiler may become unusable. Control efficiency for low NO_x burners or air staging is estimated at 40 percent for commercial boilers. NO_x control efficiencies for a recovery boiler are unavailable. Bowater has excluded the use of low NO_x burners due to the existence of air staging within the existing unit and potential impacts to operational control of the boiler. Bowater will not further evaluate LNB as a potential control strategy. Based upon recovery boiler design, the addition of a fourth level of air staging is technically feasible.

5.2.2.2.2 Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) is a control technique which uses the addition of ammonia or urea upstream of a catalyst bed operated between 480^{o}F to 800^{o}F. The addition of ammonia in the presence of oxygen and the catalyst chemically reduces NO_x compounds to nitrogen (N_2) and water vapor. Factors impacting control efficiency include operating temperatures, the quantity of reducing agent, the injection methodology, and catalyst activity.

According to the U.S. EPA (EPA-452/F-03-032), SCR systems may achieve greater than 70 percent control efficiency and are commonly associated with utility boilers, gas turbines, and process heaters. Based upon review of the RBLC database and contact with state agencies, selective catalytic reduction has not been employed as a pollution control device for a recovery furnace. No documentation of NO_x control efficiencies is available for a recovery boiler.

Limitations to the SCR technology involve ammonia slip, or the emissions of unreacted ammonia from incomplete reaction which may result in pluggage or corrosion and ammonia absorption into smelt. Catalyst poisoning from the sulfur

in the black liquor solids is also a significant impediment to use of this technology in recovery furnaces. According to Englehard Corporation and Monsanto Enviro-Chem Systems, two vendors of catalyst technologies, successful application of SCR technology to a recovery furnace would require cost-prohibitive pretreatment of the flue gas stream via wet scrubbing for sulfur control, followed by mist eliminators and an additional preheater to reach the minimum SCR operating temperature of 450^{o}F. Furthermore, SCR technology has not been demonstrated on a recovery furnace and, therefore, Englehard Corporation and Monsanto Enviro-Chem are unable to guarantee SCR system performance for such an application.

Bowater has excluded the use of SCR technology due to potential corrosion issues and potential contamination of the recovered smelt and damage to the existing ESP or downstream equipment. As a result of ammonia slip concerns, SCR could potentially impact the quality of the product and/or the recovery of smelt for use in the process. Additional environmental and safety considerations arise from the disposal of the spent catalyst and the transportation, storage, and handling of large quantities of ammonia. Based on the technical obstacles and potential negative environmental and operational impacts associated with the application of SCR technology to recovery furnaces, this technology is rejected from further consideration.

5.2.2.2.3 Selective Non-Catalytic Reduction (SNCR)

Selective Non-Catalytic Reduction (SNCR) involves the non-catalytic decomposition of NO_x in the flue gas to nitrogen and water using ammonia or urea as reducing agents. These agents are injected into the flue gas at a location near the furnace exit to provide the optimum reaction temperature and residence time. Although SNCR is an effective NO_x reduction technology, it is critically temperature dependent, requiring flue gas temperatures between 1600 and 2200^{o}F. Below the optimum temperature range, ammonia is formed with no effect on NO_x emissions. At temperatures higher than 2200^{o}F, the nitrogen compound added becomes additional NO_x. The No. 3 recovery

furnace exhaust is well below the optimum temperature range. Additionally, there are significant safety concerns associated with the injection of liquids into a recovery furnace. The recovery furnace's lower exhaust temperature would require that the ammonia or urea be injected as close as possible to the primary combustion zone. Steam explosions can occur when water droplets mix with the molten kraft pulping salts resulting from the black liquor combustion. The potential explosion hazard from microscopic steam leaks in the recovery furnace's water tube side walls in regular recovery furnace operation is high enough that additional explosion risk from SNCR operation renders it technically infeasible from a safety point of view.

There are no known applications of SNCR for recovery furnaces in the United States and there are technical feasibility issues that prevent this technology from being readily applied. Consequently, the use of SNCR technology is eliminated from further BACT/LAER consideration.

5.2.2.2.4 Flue Gas Recirculation (FGR)

Flue Gas Recirculation involves the routing of a portion of flue gases back to the primary combustion zone to replace combustion air. The flue gas provides inert gases that reduce the available oxygen during combustion and lowers the flame temperature. Based upon review of the RBLC Database and contact with state agencies, FGR has not been employed as a pollution control device for NO_x emissions from kraft recovery furnaces.

FGR systems may achieve control efficiencies between 20 to 50 percent and are commonly associated with utility boilers and process heaters. Limitations to the FGR technology involve pluggage from high particulate loadings and design constraints. FGR technology is based upon the control of thermal NO_x formation for oil and gas-fired boilers. FGR may result in loss of boiler efficiency. Bowater has excluded the use of FGR technology due to potential pluggage issue from smelt carryover, loss of boiler efficiency, and the lack of NO_x control from

fuels. Furthermore, decreasing the combustion temperature could potentially impact combustion controls and the recovery of smelt for use in the process and subsequent product quality.

5.2.2.2.5 Oxidation/Reduction Scrubbing (O/R)

Scrubbers involve the use of packed columns or trays to facilitate contact between either a water or chemical solution to facilitate the preferential absorption of pollutants from the air stream to scrubbant solution for collection, treatment, and disposal. Oxidation/Reduction scrubbing (O/R) facilitate the removal of NO_2 through the use of a caustic scrubbant or ozone injection. Scrubbers are more commonly employed for use in controlling low dust loadings or soluble inorganic vapors.

Based upon review of the RBLC and contact with state agencies, scrubbers have not been employed as a pollution control device for NO_x emissions from kraft recovery furnaces. Belco Technologies Corporation has reported a wet scrubbing system capable of achieving a >99% reduction in NO_x from process heaters with flow rates up to 500,000 cubic feet per minute within the NEET database. Theoretical NO_x removal efficiencies of 90 percent for O/R scrubbing have been reported by manufacturers of the control equipment.

O/R Scrubbing is based upon several stages which include the following:

- Cooling of flue gases to its dew point temperature (approximately 150 to 250^{o}F) to condense water vapor from the exhaust stream.
- Injection of ozone or sodium chlorite into a reaction chamber to cause a low temperature oxidation of NO_x to higher oxides.
- Higher oxides formed within the reaction chamber are removed by absorption using a caustic scrubbing system. A nitric acid solution is created as a byproduct.

Although NO_x may be removed from the post-ESP exhaust stream, the cooling of the exhaust stream will likely result in a visible plume with a potential to contain nitric acid. To prevent in-stack condensation of acid gases, the saturated flue gas must be heated to protect downstream equipment and ambient impacts.

Bowater has excluded the use of O/R scrubbing technology due to potential for damage to the process equipment, the generation of large quantities of acidic wastewater, and safety considerations regarding the storage and use of ozone. Furthermore, the heating of the flue gas post-scrubbing will result in added NO_x formation from fuel combustion in a NO_x non-attainment area. Lastly, the pressure drop to facilitate NO_x removal at the elevated flow rate may impact recovery boiler operational capabilities and limit firing rates.

5.2.2.3 Control Technology Cost Estimates

Upon review of the RBLC and the NEET databases, Bowater has determined the sole technology technically feasible for NO_x control is the addition of a 4th layer of combustion air to the staged combustion process. As good combustion control is the only technically feasible NOx control option for firing black liquor solids, the cost-effectiveness of the other options determined to be technically infeasible was not determined by Bowater.

5.2.2.4 Selection of BACT/LAER

The RBLC identifies BACT/LAER for NOx emissions while firing black liquor solids as good combustion practices, air staging, or a 4th level of air in the recovery boiler. Bowater proposes the addition of a 4th level of combustion air in an attempt to reduce NO_x formation. No control efficiency is known or credited for the addition of the 4th level of air to the combustion chamber. Based upon the lack of technically feasible control options, BACT/LAER is the addition of a 4th level of combustion air and combustion controls. This technology is also the NOx control level required for new recovery furnaces by SC Standard No. 5.2, Control of Oxides of Nitrogen.

Based upon previous BACT/LAER determinations for recovery furnaces and the existing NOx BACT limit of 80 ppmv, BACT/LAER for NO_x is 80 ppmv corrected to 8 percent oxygen for the Catawba Mill. This emission limit represents the lowest current NO_x limit in the RBLC. Bowater requests a 80 ppmv NOx limit as BACT/LAER for the No. 3 recovery furnace. This level is less than the 100 ppmv NO_x limit for new recovery furnaces in SC Standard No. 5.2.

5.2.3 Particulate Matter less than Ten Microns

The 2001 BACT analysis for the No. 3 recovery furnace established 0.036 grains per dry standard cubic foot (gr/dscf) by volume (dry basis) at eight percent oxygen using an electrostatic precipitator as BACT. Bowater currently utilizes an electrostatic precipitator to control PM_{10} emissions from the No. 3 recovery furnace.

5.2.3.1 Available Control Technologies

Bowater evaluated control technologies for particulate matter less than 10 microns (PM_{10}) emissions from kraft recovery furnaces through a review of the RBLC database, the EPA NEET Clean Air Technologies Database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets. A summary of the BACT determinations for existing recovery furnaces is contained in Table 5.3.

Table 5.3
Summary of PM/PM_{10} RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
AL-0002	SCOTT PAPER	MOBILE	AL	0.044	Grain/dscf @ 8% O_2	ESP
AL-0015	HAMMERMILL PAPER	DALLAS	AL	66.2	LB/HR	ESP
AL-0015	HAMMERMILL PAPER	DALLAS	AL	4	LB/ADTP	ESP
AL-0019	UNION COMP CORPORATION		AL	0.044	Grain/dscf @ 8% O_2	ESP
AL-0020	INDEPENDENT KRAFT CORPORATION		AL	0.044	Grain/dscf @ 8% O_2	ESP
AL-0039	MEAD COATED BOARD	RUSSELL	AL	0.044	GRAIN/DSCF @ 8% O_2	ESP & INCINERATION
AL-0042	CHAMPION INTERNATIONAL	LAWRENCE	AL	0.027	GRAIN/DSCF @ 8% O_2	ESP
AL-0097	MEAD COATED BOARD, INC.	PHENIX CITY	AL	0.036	GRAIN/DSCF @	ESP

Table 5.3
Summary of PM/PM_{10} RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
					8% O_2	
AL-0131	SCOTT PAPER COMPANY	MOBILE	AL	0.025	GRAIN/DSCF @ 8% O_2	ESP
AR-0013	NEKOOSA PAPER COMPANY		AR	0.044	Grain/dscf @ 8% O_2	ESP
CA-0032A	SIMPSON LEE PAPER COMPANY	SHASTA	CA	0.15	GRAIN/DSCF @ 8% O_2	ESP
CA-0278	LOUISIANA-PACIFIC CORPORATION	SAMOA	CA	0.025	GRAIN/DSCF	ESP
FL-0035	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	0.044	GRAIN/DSCF @ 8% O_2	ESP
FL-0058	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	0.033	GRAIN/DSCF @ 8% O_2	ESP
FL-0099	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	0.030	GRAIN/DSCF @ 8% O_2	ESP
GA-0028	GREAT SOUTHERN PAPER	CEDAR SPRINGS	GA	0.030	GRAIN/DSCF @ 8% O_2	ESP
GA-0092	GEORGIA-PACIFIC CORPORATION	EARLY	GA	0.032	GRAIN/DSCF @ 8% O_2	ESP
GA-0114	TEMPLE INLAND, INC.	FLOYD	GA	0.021	GRAIN/DSCF @ 8% O_2	ESP
ID-0003	POTLATCH CORPORATION	LEWISTON	ID	0.030	GRAIN/DSCF @ 8% O_2	ESP
KY-0001A	WILLAMETTE INDUSTRIES	HANCOCK	KY	0.040	GRAIN/DSCF @ 8% O_2	ESP
KY-0039A	WILLAMETTE INDUSTRIES	HANCOCK	KY	0.040	GRAIN/DSCF @ 8% O_2	ESP
KY-0067	WILLAMETTE INDUSTRIES	HANCOCK	KY	0.025	GRAIN/DSCF @ 8% O_2	ESP
KY-0085	MEADWESTVACO	BALLARD	KY	1.35	LB/ADTP	ESP AND WET SCRUBBER
LA-0075	INTERNATIONAL PAPER COMPANY	MOREHOUSE	LA	0.024	GRAIN/DSCF @ 8% O_2	ESP
LA-0117	GAYLORD CONTAINER CORPORATION	WASHINGTON	LA	78.64	LB/HR	NONE LISTED
LA-0122	INTERNATIONAL PAPER – MANSFIELD MILL	DESOTO PARISH	LA	96.5	LB/HR	ESP
LA-0155	CROWN PAPER COMPANY	WEST FELICIANA PARISH	LA	0.044	GRAIN/DSCF @ 8% O_2	ESP
LA-0174	GEORGIA-PACIFIC CORPORATION	EAST BATON ROUGE	LA	0.025	GRAIN/DSCF @ 8% O_2	ESP
ME-0009	BOISE CASCADE	OXFORD	ME	0.044	GRAIN/DSCF @ 8% O_2	ESP
ME-0010	GEORGIA-PACIFIC CORPORATION	WASHINGTON	ME	0.021	GRAIN/DSCF @ 8% O_2	ESP
ME-0011	S. D. WARREN COMPANY	CUMBERLAND	ME	0.021	GRAIN/DSCF @ 8% O_2	ESP
ME-0030	LINCOLN PULP AND PAPER COMPANY	PENOBSCOT	ME	0.044	GRAIN/DSCF @ 8% O_2	ESP
MI-0024	CHAMPION INTERNATIONAL	DICKINSON	MI	0.044	GRAIN/DSCF @ 8% O_2	ESP
MS-0005	WEYERHAUSER CO.	LOWNDES	MS	0.044	GRAIN/DSCF @ 8% O_2	ESP
MS-0008	LEAF RIVER FOREST PRODUCTS	PERRY	MS	0.044	GRAIN/DSCF @	ESP

Table 5.3
Summary of PM/PM_{10} RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
					8% O_2	
MS-0015	WEYERHAEUSER CO.	COLUMBUS	MS	0.030	GRAIN/DSCF @ 8% O_2	ESP
MS-0022	LEAF RIVER FOREST PRODUCTS	PERRY	MS	0.040	GRAIN/DSCF @ 8% O_2	ESP
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	0.023	GRAIN/DSCF @ 8% O_2	ESP
NC-0089	CHAMPION INTERNATIONAL CORPORATION	HALIFAX	NC	0.021	GRAIN/DSCF @ 8% O_2	ESP
NC-0092	INTERNATIONAL PAPER COMPANY	COLUMBUS	NC	0.044	GRAIN/DSCF @ 8% O_2	ESP
PA-0090	PENTECH PAPERS INCORPORATED	ELK	PA	0.027	GRAIN/DSCF @ 8% O_2	ESP
SC-0003	WESTVACO CORPORATION	CHARLESTON	SC	0.027	GRAIN/DSCF @ 8% O_2	ESP
SC-0013	BOWATER CAROLINA	YORK	SC	0.044	GRAIN/DSCF @ 8% O_2	ESP
SC-0014	UNION CAMP CO.	RICHLAND	SC	0.044	GRAIN/DSCF @ 8% O_2	ESP
SC-0015	WILLAMETTE INDUSTRIES	MARLBORO	SC	0.030	GRAIN/DSCF @ 8% O_2	ESP
SC-0016	UNION CAMP PULP AND PAPER MILL	RICHLAND	SC	0.030	GRAIN/DSCF @ 8% O_2	ESP
SC-0016	UNION CAMP PULP AND PAPER MILL	RICHLAND	SC	0.036	GRAIN/DSCF @ 8% O_2	ESP
SC-0045	WILLAMETTE INDUSTRIES	MARLBORO	SC	0.021	GRAIN/DSCF @ 8% O_2	ESP
SC-0083	WEYERHAUSER CORPORATION	MARLBORO	SC	0.021	GRAIN/DSCF @ 8% O_2	ESP
SC-0084	BOWATER	YORK	SC	0.036	GRAIN/DSCF @ 8% O_2	ESP
TX-0071	KIRBY FORREST INDUSTRIES	NEWTON	TX	83.4 0.09	LB/HR LB/MM BTU	WET BOTTOM ESP
TX-0263	DONAHUE INDUSTRIES	ANGELINE	TX	50.5	LB/HR	NONE
VA-0173	CHESAPEAKE CORP.	CHESAPEAKE	VA	0.030	GRAIN/DSCF @ 8% O_2	ESP
WA-0002	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	0.027	GRAIN/DSCF @ 8% O_2	ESP
WA-0013	WEYERHAUSER CORPORATION		WA	0.06	GRAIN/DSCF @ 8% O_2	ESP
WA-0022	JAMES RIVER CORPORATION	CAMAS	WA	0.033	GRAIN/DSCF @ 8% O_2	ESP
WA-0022	JAMES RIVER CORPORATION	CAMAS	WA	0.033	GRAIN/DSCF @ 8% O_2	ESP
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	0.033	GRAIN/DSCF @ 8% O_2	NONE LISTED
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	0.044	GRAIN/DSCF @ 8% O_2	NONE LISTED
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	0.040	GRAIN/DSCF @ 8% O_2	NONE LISTED
WA-0303	LONGVIEW FIBRE COMPANY	OLYMPIA	WA	0.027	GRAIN/DSCF @ 8% O_2	NONE LISTED
WI-0141	MOSINEE PAPER CORPORATION	MARATHON	WI	0.027	GRAIN/DSCF @	ESP

Table 5.3
Summary of PM/PM_{10} RBLC Determinations
Existing Kraft Recovery Furnaces

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
					8% O_2	
WI-0208	DOTMAR INDUSTRIES, INCORPORATED	WOOD	WI	0.030	GRAIN/DSCF @ 8% O_2	ESP

Of the previous BACT determinations listed in the RBLC database for existing recovery furnaces, the only selected primary PM control measure is an electrostatic precipitator. Emission limits within the RBLC database range from 0.021 to 0.044 grains/dscf utilizing an electrostatic precipitator as the control method. The median PM_{10} limit is 0.033 grains/dscf. The most recent determination is 0.021 gr/dscf for the furnace at Weyerhaeuser facility in Marlboro County, South Carolina. As indicated in Table 5.3, no other PM_{10} control technologies have been considered BACT for recovery furnaces.

5.2.3.2 Potential Control Technologies

Emission control technologies potentially applicable for the removal or collection of PM_{10} from recovery furnaces were initially evaluated based upon technical feasibility. Technologies determined to be technically infeasible were excluded from further evaluation. Control technologies evaluated, as discussed below, included upgrading the existing electrostatic precipitator, fabric filters/baghouse, and wet scrubbers.

5.2.3.2.1 Electrostatic Precipitators (ESP)

Electrostatic precipitators facilitate the removal of PM_{10} through the creation of a corona which electrically charges materials within the exhaust stream. As the charged particles pass through grates or collectors of opposite charge, the particles are removed from the air stream and adhere to a collector plate. Vibration or mechanical measures are used to removed the removed particles from the collector plate for disposal. ESPs are widely utilized for control of particulate matter emissions within the pulp and paper industry. Control efficiencies typically range from 99 to 99.9 percent. Bowater currently utilizes an ESP to

control PM_{10} emissions from the kraft recovery furnace. Although any increase in PM_{10} control efficiency would require the replacement of the existing ESP and the associated capital cost, the technology is considered technically feasible.

5.2.3.2.2 Fabric Filters / Baghouse

Baghouses or fabric filters are particulate matter control devices which utilize a woven fabric to separate coarse and fine particulates from an air stream as it passes through the fabric. The particulate matter is then mechanically removed from the fabric surface and collected for disposal. Control efficiencies typically range from 95 to 99.9 percent. According to the U. S. EPA (EPA-452/F-03-025), fabric filters or baghouses do not operate well with temperatures in excess of 290^{o}F, in the presence of moisture, or hygroscopic salts. Bowater has excluded the use of fabric filters as a control technology due to potential fouling concerns due to moisture content, temperature, and presence of salts within the exhaust stream. There are no fabric filters in use on existing recovery furnaces in the U.S. Furthermore, Bowater currently utilizes an Electrostatic Precipitator which represents a more efficient control system.

5.2.3.2.3 Wet Scrubbers

Wet Scrubbers are particulate matter control devices which utilize contact of liquid scrubbant and the air stream to separate coarse and fine particulates. The particulate matter accumulates within the spent scrubbing solution prior to treatment or disposal. Control efficiencies typically range from 70 to 99 percent. According to the U. S. EPA (EPA-452/F-03-017), wet scrubbers have a potential to cause corrosion, a visible plume, and generate a liquid waste stream for disposal. Bowater has excluded the use of scrubbers as a control technology due to potential corrosion concerns, a lower control efficiency than existing equipment, and the generation of a liquid waste for further treatment.

5.2.3.3 Control Technology Cost Estimates

Upon review of the RBLC and the NEET databases, Bowater has determined the sole technology technically feasible for PM_{10} control for the recovery boiler is the use of an electrostatic precipitator. Control costs have been evaluated for PM_{10} from the No. 3 recovery furnace using the EPA approved Air Compliance Advisor software. In order to achieve a PM_{10} emission rate of 0.021 gr/dscf, Bowater would have to install a new ESP unit. The cost-effectiveness of ESP modifications was determined by dividing the incremental annual cost difference by the theoretical PM_{10} emissions reduction in tons per year for the control option.

The capital cost for the installation of a new ESP was determined using the formulas provided in Air Compliance Advisor (ACA) model. ACA determines costs based upon: 1) basic equipment costs, 2) ancillary equipment costs, 3) instruments and controls, taxes, and freight, and 4) indirect equipment costs.

Pulp production losses have also been considered in the capital cost section of the cost analysis. For the plant to install a new ESP system, the recovery furnace and the associated pulp production process must be shutdown for a period of time. The plant typically schedules 5 days of downtime for maintenance and repair of No. 3 recovery furnace each year. It is assumed that these 5 days could be used within the shutdown period required to allow for the necessary construction and installation efforts. Due to the difficulty associated with installation of new equipment and retrofit controls, it is estimated that the effort will take at least 30 days to complete. Beyond the 5 days of scheduled downtime, the plant will have pulp production losses for a minimum of 25 days. The Catawba plant produces approximately 1,675 tons of bleached kraft pulp per day. The No. 3 recovery furnace processes approximately sixty percent of the black liquor solids generated from the kraft pulp mill. Therefore, approximately 1,005 tons of bleached kraft pulp production will be lost each day the No. 3 recovery furnace is shutdown.

The methodology used to determine the monetary amount associated with these losses was found in Section 6.1.1.1 of U.S. EPA's Technical Document for Chemical Recovery Combustion

Sources at Kraft and Soda Pulp Mills. This document assumes that kraft mills achieve an earnings margin of 25 percent; and subsequently, the value of the lost pulp production is estimated to be equal to approximately 25 percent of the total market value. The market value for bleached pulp listed in this document is $646 per air-dried ton of pulp in 1991 dollars. Using the VAPCCI index and the Bureau of Labor Adjustment factor, this market value was escalated to $1,167 per air-dried ton of pulp in 2005 dollars. This cost associated with production losses will be added to the total capital investment when determining the annualized capital recovery cost.

A control cost analysis was conducted to determine the cost effectiveness of upgrading the existing ESP. The total annualized cost of the upgrade was determined by calculating the incremental difference between the annualized cost of the existing ESP and the annualized cost of the modified or upgraded ESP. This incremental cost difference was then divided by the additional emissions reduction provided by the ESP modification (additional plate area) to determine the cost effectiveness of upgrading the existing system.

The incremental cost difference between the existing and modified ESP to achieve 0.030 gr/dscf was determined to be approximately $1,939,609. The emissions reduction achieved going from 0.036 gr/dscf down to 0.030 gr/dscf is estimated to be 57 tons of particulate matter per year. Based on these determinations, the cost effectiveness is approximately $34,023 per ton of particulate reduced. At this rate, it is not cost-effective for the plant to upgrade the existing ESP to reduce PM_{10} emissions to 0.030gr/dscf.

The incremental cost difference between the existing and modified ESP to achieve 0.021 gr/dscf was determined to be approximately $2,145,600. The emissions reduction achieved going from 0.036 gr/dscf down to 0.021 gr/dscf is estimated to be 142.5 tons of particulate matter per year. Based on these determinations, the cost effectiveness is approximately $15,054 per ton of particulate reduced. At this rate, it is not cost-effective for the plant to upgrade the existing ESP to reduce PM_{10} emissions to 0.021gr/dscf.

Bowater performed incremental cost analyses for PM_{10} emission rates of 0.027, 0.025, and 0.023 grains per dry standard cubic feet. In each case, Bowater determined the modification of the ESP is not cost effective.

5.2.3.4 Selection of BACT

Fabric filters and baghouses can achieve PM_{10} removal efficiencies similar to ESP's. However, the use of fabric filters/baghouses for PM_{10} removal are not technically feasible due to the high moisture content of the gas stream and hygroscopic salts (particulates) in the flue gas, which would very quickly "blind" the collection bags. Wet scrubbers are generally not as efficient as ESP's at removing PM_{10}, are not considered BACT for the recovery furnace. Therefore, an electrostatic precipitator is BACT.

The incremental cost difference between the existing and modified ESP was determined to be greater than or equal to $18,964 based upon the level of control. At these rates, it is not cost-effective for the plant to upgrade the existing ESP. Following the planned modifications to the No. 3 recovery furnace, the existing ESP will still provide a significant reduction in particulate emissions. The existing ESP at an emission rate of 0.036 gr/dscf is considered BACT for particulate matter emissions from the recovery furnace.

5.3 No. 2 Lime Kiln

The No. 2 lime kiln was built in 1994 and received a PSD synthetic minor construction permit. The 1994 construction permit included emission limits for PM_{10}, SO_2, and NO_X.

The No. 2 lime kiln will have a net increase in emissions for CO, PM_{10}, SO_2, NO_X, VOCs, and TRS. VOC, CO, and TRS emissions increases for the proposed project do not exceed the,PSD significant emission rates, so BACT is not required for these compounds. The Charlotte-Gastonia-Rock Hill, NC-SC area was designated a non-attainment area for ozone on June 15, 2004. Based upon the non-attainment status for ozone, Bowater must perform a LAER analysis for NO_x emissions, while BACT must be addressed forPM_{10} and SO_2.

5.3.1 Sulfur Dioxide

The net increase in sulfur dioxide (SO_2) emissions from the modification to No. 2 lime kiln is the result of the increased lime and fuel firing.

5.3.1.1 Demonstrated Control Technologies

Bowater has evaluated control technologies for sulfur dioxide emissions from No. 2 lime kiln through the review of the RBLC database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets.

The RBLC contains fifteen (15) SO_2 BACT determinations for modifications to existing lime kilns. BACT determinations for new lime kilns were excluded from further evaluation. A summary of the BACT determinations for lime kilns is contained in Table 5.4.

Table 5.4
Summary of SO_2 RBLC Determinations
Existing Lime Kilns

RBLCID	FACILITY	COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
FL-0087	CHAMPION INTERNATIONAL CORP	ESCAMBIA	FL	6.49	LB/HR	NONE
GA-0064	RIVERWOOD INTERNATIONAL CORPORATION	MACON	GA	41.6	LB/HR	NONE LISTED
LA-0074	WILLAMETTE INDUSTRIES INCORPORATED	NATCHITOCHES	LA	22.6	LB/HR	CAUSTIC SCRUBBER
LA-0122	INTERNATIONAL PAPER - MANSFIELD MILL	DESOTO PARISH	LA	8.4	LB/HR	WET SCRUBBER
LA-0174	GEORGIA-PACIFIC CORPORATION- PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	3.26	LB/HR	WET SCRUBBING AND OPTIMAL MUD WASHING
LA-0174	GEORGIA-PACIFIC CORPORATION- PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	2.59	LB/HR	WET SCRUBBING AND OPTIMAL MUD WASHING
ME-0030	LINCOLN PULP AND PAPER COMPANY, INCORPORATED	PENOBSCOT	ME	50 14.1	PPMV @10%O2 LB/HR	KILN OPERATION, LOW SULFUR FUEL, WET SCRUBBER
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	50	PPMV @10%O2	LOW SULFUR FUELS
SC-0015	WILLAMETTE INDUSTRIES	MARLBORO	SC	10.5	LB/HR	CHEMICAL REACTION WITH LIME
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	MARLBORO	SC	30 10.5	PPMV @10%O2 LB/HR	NONE (NOT BACT)
TX-0263	DONAHUE INDUSTRIES, INC.	ANGELINE	TX	5.4	LB/HR	WET SCRUBBER AND NATURAL GAS
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	20	PPMV @10%O2	NONE (NOT BACT)

The selected control technologies for existing lime kilns include wet scrubbers, kiln design and operation, and fuel specifications. From the BACT Clearinghouse, the most stringent emission limit for SO_2 is associated with the Georgia-Pacific facility in East Baton Rouge Parish, Louisiana. Through contact with lime mud and a wet scrubber, SO_2 emissions from the East Baton Rouge Parish facility are established at 2.59 pounds per hour. On a parts per million basis, the lowest BACT limit is 50 ppmv for the Lincoln Pulp and Paper Company (Penobscot, ME) and Weyerhauser Company (Columbus, MS). Since BACT limits that are established on a pound per hour or ton per year basis are applicable to the individual site operating conditions (i.e. loading, flow rate, etc.), comparison of emission limits to the Catawba Mill is inappropriate.

Longview Fibre Company received an SO_2 limit of 20 ppmv at 10% oxygen for PSD avoidance purposes. Longview Fibre operates five lime kilns ranging from 140 to 325 tons of CaO per day, which is significantly smaller in size than the No. 2 Lime Kiln in Catawba, South Carolina. Because this determination in the clearinghouse does not represent a BACT limit, the BACT determination for Longview Fibre Company has been eliminated from further consideration in this BACT analysis.

Willamette Industries permitted SO_2 emissions from a 450 tons CaO/day lime kiln in 1996. A SO_2 limit of 30 ppmv at 10% oxygen was established on a case-by-case basis, not BACT. The Marlboro Mill lime kiln is fired on natural gas, not fuel oil. Bowater has eliminated this entry from further evaluation based upon firing rates significantly lower than the modified equipment at the Catawba Mill, the fuel fired, and the determination basis (not BACT).

In 1984, Champion International performed modifications to an existing lime kiln as a result of wastewater discharge problems for the facility and public complaints. Champion International installed an oversized mud dryer on the lime kiln to allow for lower caustic usage on an SO_2 scrubber located downstream of an ESP. No SO_2 control efficiency was attributed to the mud dryer. According to Mr. Bruce Mitchell of the Florida Department of Environmental Protection, a SO_2 limit of 6.49 pounds per hour was established to avoid PSD permitting. Mr. Mitchell

stated that the limit was based upon source testing performed over a two year period. Because this determination in the clearinghouse does not represent a BACT limit and was driven by community relations concerns, the determination for Champion International has been eliminated from further consideration in this BACT analysis.

Bowater's No. 2 lime kiln is designed to emit minimal SO_2 through contact with lime mud within the combustion chamber. Although not designed for SO_2 control, the No. 2 Lime Kiln modification involves the addition of a lime mud pre-dryer using the lime kiln flue gases for heat rather than steam.

5.3.1.2 Potential Control Technologies

Emission control technologies potentially applicable for the removal or destruction of sulfur dioxide from an air stream were initially evaluated based upon technical feasibility. Technologies determined to be technically infeasible were excluded from further evaluation. Control technologies evaluated, as discussed below, include wet scrubbers and kiln design.

5.3.1.2.1 Wet Scrubbers

A wet scrubber removes gaseous contaminants from a gas stream through intimate contact with suitable absorbing or wetting liquor, such as caustic. Based upon review of the RBLC and contact with state agencies, wet scrubbers have been employed as a pollution control device for SO2 emissions from lime kilns at kraft pulp mills. Packed bed scrubbers were not considered for this application due to the high particulate loadings and potential for pluggage.

Bowater has determined SO_2 scrubbing systems are technically feasible. However, wet scrubbers are more typically used on large fossil fuel fired utility boilers with much higher outlet SO_2 concentrations.

5.3.1.2.2 Kiln Design

Lime kilns have inherent SO2 control within the kiln. The regenerated quicklime in the kiln acts as an in situ scrubbing agent. The lime dust in the exhaust also creates alkaline conditions. As part of the proposed project, Bowater will add a preheater to the No. 2 lime kiln which will recycle the kiln exhaust, providing additional contact between kiln gases and the lime, reducing SO_2 emissions through kiln design.

5.3.1.3 Control Technology Cost Estimates

Upon review of the RBLC and the NEET databases, Bowater has determined the sole add-on control technology technically feasible for SO_2 control for the lime kiln is the use of a wet scrubber system. Control costs have been evaluated for wet scrubber control of sulfur dioxide from the No. 2 lime kiln. The existing process configuration minimizes SO_2 emissions through the kiln design, and the addition of the preheater will enhance the inherent SO_2 control in the kiln. The cost-effectiveness of additional add-on SO_2 control was determined by dividing the incremental annual cost difference by the theoretical SO_2 emissions reduction in tons per year for the control option.

The capital costs for the installation of a wet scrubbing system were determined using vendor estimates and formulas provided in Section 6.2 of the EPA Air Pollution Control Cost Manual, Sixth Edition (APCCM). Basic equipment cost for a wet scrubber system is based on the air flow and pollutant loading. Ancillary equipment costs were determined based on the APCCM guidance document. The purchased equipment cost includes the equipment costs plus additional costs associated with instruments and controls, taxes, and freight. These additional costs are typically estimated at eighteen percent of the equipment costs. The total capital investment for the wet scrubber system is estimated based on a series of factors applied to the purchased equipment cost to obtain direct and indirect installation costs. These costs are then added to the purchased equipment cost to determine the total capital investment.

Pulp production losses have also been considered in the capital cost section of to cost analysis. For the plant to install the scrubber system, the lime kiln and the associated pulp production process must be shutdown for a period of time. As a conservative estimate, pulp losses are not included in the cost estimate.

Direct annual costs include operating and supervisory labor, operating materials, replacement parts, maintenance labor and materials, electricity, and dust disposal. Typical labor rates and material cost determinations have been determined based on APCCM assumptions for venturi scrubbers (the acid gas control section of the APCCM only addressed packed tower absorbers). APCCM states that typical operating labor requirements are 2 to 8 hours per shift for each scrubber system and the supervisory labor is assumed to be fifteen percent of operating labor. The example in the APCCM uses 3 hours per shift and $20/hr. Maintenance labor is estimated at 1 hour per shift at a rate of $20/hr.

The electricity price of $0.046 per kilowatt-hour was used in the electricity cost determinations. The annual cost of electricity is based on the inlet stream flow rate, pressure drop, and pump/blower size. This cost was determined using the formula found in the APCCM. The scrubber system will also have water, scrubbing solution, waste disposal, and wastewater treatment costs. These costs have been determined using the formulas found in the APCCM.

Indirect annual costs have been determined for the scrubber system. These indirect costs include overhead, taxes, insurance, administrative costs, and capital recovery. Overhead costs are assumed to be 60% of operating and maintenance costs, as presented by APCCM. Taxes, insurance, and administrative costs are assumed to be four percent of the total capital investment, not including pulp production losses. Capital recovery is determined using a factor based on an equipment life of 15 years and an interest rate of ten percent. Per the 1990 OAQPS Control Cost Manual, the interest rate used in the cost calculations is a pretax marginal rate of return on private investment, or a "real private rate of return." Most manufacturers expect a rate-of-return on capital expenditures of ten percent or higher. This factor is then multiplied by the total capital investment, including pulp production losses.

This cost effectiveness of installing a SO_2 scrubber is based upon the annualized costs divided by the emissions reduction provided by the additional control. Using vendor information and APCCM formulas, the total capital investment for a scrubber system has been estimated at $5,790,000 without pulping losses. When accounting for annual costs and capital recovery factors, the total annualized cost for the SO_2 controls is $1,960,818.

Based upon future actual emissions, the proposed modifications result in an increase of 34 tons per year of SO_2 from the lime kiln. The cost of the additional SO_2 control is $64,079 per ton of pollutant removed, based on an expected 90 percent control efficiency at the relatively low level of SO_2 emissions from the lime kiln. Bowater does not feel that control of SO_2 emissions is cost effective at $64,079 per ton of pollutant removed. Based upon the potential SO_2 emissions from the lime kiln of 173 tpy and 90 percent control, the cost effectiveness of the control technology is $12,594 per ton of pollutant removed. Bowater does not feel that additional control of SO_2 emissions from the No. 2 lime kiln is cost effective at either level of SO_2 reduction.

Due to the high SO_2 removal due to contact with lime mud, Bowater does not anticipate that a wet scrubber following the lime kiln would actually achieve a 90% control efficiency. While not designed for SO_2 control, the pre-heater installation will facilitate additional SO_2 removal, thereby decreasing concentrations to an add-on scrubber.

5.3.1.4 Selection of BACT

The process by which kraft pulp mill lime kilns convert lime mud ($CaCO_3$) into quick lime (CaO) minimizes SO_2 emissions through direct contact between the flue gas and lime mud down the length of the kiln. This prolonged contact between the lime mud and flue gas not only accomplishes the desired conversion from lime mud to quick lime, it also has been shown to remove greater than 99 percent of the SO_2 from the flue gas at similarly operated lime kilns. As part of the proposed project, Bowater will install a preheater that will increase the amount of contact between the lime mud and flue gas and enhance the inherent SO_2 control in the kiln.

Wet scrubbing is the sole technically feasible add-on control technology that is commonly employed at pulp and paper mills. Traditionally, pulp and paper mills installed wet scrubbers to control particulate emissions, while the caustic solution provided SO_2 control. Bowater utilizes an ESP for improved particulate control over scrubbing systems, while no add-on SO_2 controls are present. To facilitate SO_2 removal, Bowater would have to install a wet scrubber down-stream from the ESP. Bowater has determined that the installation of a wet scrubbing system is not cost effective. Therefore, the proper operation of the No. 2 lime kiln is BACT.

Upon review of the RBLC database, BACT limits (pounds per hour or tons per year) established using wet scrubbing are not applicable based upon the cost effectiveness of the technology. Based upon vendor information regarding SO_2 emissions and historical emissions and operating data, Bowater requests an SO_2 limit of 50 ppmv at 10% oxygen (24-hour average). This represents the lowest SO_2 emission rate listed within the RBLC database without the use of a wet scrubber.

5.3.2 Nitrogen Oxides (NO_X)

Nitrogen oxides (NO_x) are formed from the reaction of nitrogen (N_2) and oxygen (O_2) within the combustion air thus creating thermal NO_x. Increased quantities of oxygen in the combustion zone results in greater amounts of NO_x formation. Once formed, the decomposition of NO_x at lower temperatures, although thermodynamically favorable, is kinetically limited. Thus, NO_x control strategies are based upon reducing formation of NO_x within the combustion zone by reducing the combustion temperature, oxygen concentration in the high temperature combustion zone, and the gas residence time at high temperatures. Thermal NO_x formation is dependant on elevated temperatures (>2,800^{o}F).

Based upon the attainment status of the region, this BACT analysis includes a LAER analysis.

5.3.2.1 Available Control Technologies

Bowater has evaluated control technologies for NO_X emissions from the No. 2 lime kiln through the review of the RBLC database, the EPA NEET Clean Air Technologies Database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets. A summary of the BACT/LAER determinations for existing lime kilns is contained in Table 5.5.

Table 5.5
Summary of NO_x RBLC Determinations
Existing Lime Kilns

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DECSRIPTION
FL-0058	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	290	PPMV @10%O2	COMBUSTION CONTROL
FL-0087	CHAMPION INTERNATIONAL CORP	ESCAMBIA	FL	200 49.3	PPM LB/HR	NONE LISTED
FL-0111	BUCKEYE FLORIDA, L.P.	TAYLOR	FL	68.44	LB/HR	GOOD COMBUSTION/ BURNER MODIFICATION
GA-0064	RIVERWOOD INTERNATIONAL CORPORATION	MACON	GA	3.5	LB/TON CAO	LOW NO_X BURNER
LA-0074	WILLAMETTE INDUSTRIES INCORPORATED	NATCHITOCHES	LA	51.5	LB/HR	DESIGN AND OPERATION
LA-0122	INTERNATIONAL PAPER - MANSFIELD MILL	DESOTO PARISH	LA	103.7	LB/HR	GOOD COMBUSTION CONTROL
LA-0174	GEORGIA-PACIFIC CORPORATION-PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	48.78	LH/HR	NONE LISTED (NOT BACT)
ME-0030	LINCOLN PULP AND PAPER COMPANY, INCORPORATED	PENOBSCOT	ME	200	PPMV @10%O2	PROPER KILN OPERATION
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	300	PPMV @ 3.9% O2	NONE LISTED
OR-0044	POPE AND TALBOT	HALSEY	OR	112 241	PPM @10%O_2 TPY	COMBUSTION CONTROL
SC-0015	WILLAMETTE INDUSTRIES	MARLBORO	SC	35	LB/HR	KILN DESIGN AND OPERATION
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	MARLBORO	SC	175 44.3	PPM LB/HR	NONE LISTED
SC-0084	BOWATER	YORK	SC	152	PPMVD @10%O2	NONE LISTED
TX-0263	DONAHUE INDUSTRIES, INC.	ANGELINE	TX	22.7	LB/HR	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	340	PPMVD @10%O2	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	340	PPMVD @10%O2	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	275	PPMVD @10%O2	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	340	PPMVD @10%O2	NONE LISTED (NOT BACT)

Of the BACT/LAER determinations listed within the RBLC database for existing lime kilns, the selected pollution control measures included good combustion practices, low NO_x burners (natural gas firing only), and kiln design. Two lime kilns in Georgia have installed low NO_X burners, and one kiln in Florida also modified the burners. The RBLC indicates that the Pope and Talbot Halsey mill installed a new burner as part of its project. As indicated in Table 5.8 no

other NO_X control technologies have been considered BACT for kraft pulp mill lime kilns. The range of BACT limits for lime kilns is 112 to 300 ppm, with a median of 175 ppm. The most recent BACT determinations for existing kilns are 152 ppm for the kiln at the Bowater Coated Paper Division operation in York, South Carolina and 112 ppm for the kiln at the Pope and Talbot Halsey Mill in Oregon.

Pope and Talbot, Inc. modified an existing lime kiln in 2004 as part of a burner replacement project. According to Mr. Jim Boylan of the Oregon Department of Environmental Quality, the modification project involved the installation of low-NO_x style burners while no control efficiency was attributed to the equipment. An initial BACT limit of 1,000 ppmv at 10% oxygen was established for the facility. Following the modification, Pope and Talbot performed twenty (20) source tests, with a modified BACT limit established as the average concentration plus one standard deviation. Mr. Boylan stated that the lime kiln is design with a firing rate of 220 tons CaO per day.

Several listings within the RBLC database are based upon non-BACT determinations including PSD avoidance limits. Non-BACT/LAER limits, often in terms of pounds per hour, are excluded from further consideration. Since emission limits that are established on a pound per hour or ton per year basis are applicable to the individual site operating conditions (i.e. loading, flow rate, etc.), comparison of emission limits to the Catawba Mill is inappropriate.

5.3.2.2 Potential Control Technologies

Emission control technologies potentially applicable for the removal or destruction of NO_x from the flue gases were initially evaluated based upon technical feasibility. Technologies determined to be technically infeasible were excluded from further evaluation. Control technologies evaluated, as discussed below, included low NO_x burners/air staging, flue gas recirculation (FGR), oxidation/reduction scrubbing (O/R), selective non-catalytic reduction (SNCR), selective catalytic reduction (SCR), non-selective catalytic reduction (NSCR), and proper design and operation.

5.3.2.2.1 Low NO_X Burners (LNB)

Combustion within a traditional boiler is facilitated by the introduction of both fuel (natural gas, fuel oil, wood, etc.) into a combustion zone where large volumes of air are combined with the fuel to obtain an optimal flame. As a result of the high air ratio within the combustion zone, flame temperatures increase as well as the formation of NO_x. Low NO_x burners (LNB) facilitate a reduction in NO_x formation by staging the combustion process in a fuel-rich environment without excess air which results in a reduction in peak flame temperatures and the available oxygen for NO_x formation.

Low NO_x burner systems are widely utilized for utility boilers and industrial furnaces. Control efficiency for low NO_x burners or air staging is estimated at 40 percent for commercial boilers. NO_x control efficiencies for LNB in a lime kiln are not available.

Flame properties within the lime kiln are critical to the calcining process to ensure a high conversion from mud to reburnt lime. Specifically, the flame shape and properties have a dramatic effect on calcining efficiency. LNB result in longer, cooler flames within the calcining area. Through the use of LNB, quality control becomes more difficult, resulting in poor efficiency, increased fuel usage, and decreased kiln capacity. The transfer of the LNB technology has proven difficult in the lime process, specifically when burning natural gas.

Low NO_X burners are not appropriate for the No. 2 lime kiln because the emission rate is already below the lowest emission rate for a lime kiln with low NO_X burners. Low NO_X burners would also likely result in lower calcining efficiency, requiring more fuel per ton of CaO production. This would increase CO emissions, and the additional fuel required may generate nearly as much NO_X as the low NO_X burners would prevent. Therefore, low NO_X burners are not

technically feasible for the No. 2 lime kiln. Bowater has excluded the use of low NO_x burners from further consideration as BACT/LAER.

5.3.2.2.2 Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) is a control technique which uses the addition of ammonia or urea upstream of a catalyst bed operated between 480^{o}F to 800^{o}F. The addition of ammonia in the presence of oxygen and the catalyst chemically reduces NO_x compounds to nitrogen (N_2) and water vapor. Factors impacting control efficiency include operating temperatures, the quantity of reducing agent, the injection methodology, and catalyst activity.

According to the U.S. EPA (EPA-452/F-03-032), SCR systems may achieve greater than 70 percent control efficiency and are commonly associated with utility boilers, gas turbines, and process heaters. Based upon review of the RBLC and contact with state agencies, selective catalytic reduction has not been employed as a pollution control device for a lime kilns. No documentation of NO_x control efficiencies is available for a lime kiln.

Limitations to the SCR technology involve ammonia slip, or the emissions of unreacted ammonia from incomplete reaction which may result in pluggage or corrosion and ammonia absorption into smelt. SCR requires temperatures be maintained within a narrow range to ensure efficient operation. Fluctuations in loading or temperatures within the kiln will disrupt the NH_3/NO_x molar ratio. Furthermore, high temperatures may result in shorted catalyst life and formation of additional NO_x. Optimum temperature ranges for SCR is 480 to 800^{o}F, while lime kilns traditionally operate at temperatures above 1,600^{o}F. Additional environmental and safety considerations arise from the disposal of the spent catalyst and the transportation, storage, and handling of large quantities of ammonia. Based on the technical obstacles and potential negative environmental

impacts associated with the application of SCR technology to lime kilns, this technology is rejected from further consideration.

5.3.2.2.3 Selective Non-Catalytic Reduction (SNCR)

Selective Non-Catalytic Reduction (SNCR) is a control technique which uses the addition of ammonia or urea to the post-combustion flue gases to chemically reduces NO_x compounds to nitrogen (N_2) and water vapor. SNCR differs from SCR in that NO_x reduction is facilitated at high temperatures without the presence of a catalyst. The reducing agent is introduced to the combustion chamber to facilitate mixing or the agent and NO_x molecules. To facilitate the reduction of NO_x using the SNCR technology, temperatures must be maintained between 1600 and 2100^{o}F. As temperature react the upper limit, NH_3 begins to oxidize.

According to the U.S. EPA (EPA-452/F-03-032), SNCR systems may achieve control efficiencies between 30 to 50 percent and are commonly associated with utility boilers, incinerators, cement kilns, and process heaters. Based upon review of the RBLC and contact with state agencies, selective non-catalytic reduction has not been employed as a pollution control device for a lime kiln. Limitations to the SNCR technology involve ammonia slip, or the emissions of unreacted ammonia from incomplete reaction, which may result in pluggage or corrosion. Bowater has excluded the use of SNCR technology due to potential corrosion issues, ammonia slip considerations, temperature constraints, and the fact that it has not been employed on a lime kiln.

5.3.2.2.4 Flue Gas Recirculation (FGR)

Flue Gas Recirculation involves the routing of a portion of flue gases back to the primary combustion zone to replace combustion air. The flue gas provides inert gases that reduce the available oxygen during combustion and lowers the flame temperature. Based upon review of the RBLC and contact with state agencies,

FGR has not been employed as a pollution control device for NO_x emissions from a lime kiln.

FGR systems may achieve control efficiencies between 20 to 50 percent and are commonly associated with utility boilers and process heaters. Limitations to the FGR technology involve pluggage from high particulate loadings and design constraints. FGR technology is based upon the control of thermal NO_x formation for oil and gas-fired boilers. As part of the proposed project, Bowater will install a pre-dryer before the lime kiln, which will use flue gas recirculation to preheat the lime entering the kiln.

5.3.2.2.5 Oxidation/Reduction Scrubbing (O/R)

Scrubbers involve the use of packed columns or trays to facilitate contact between either a water or chemical solution to facilitate the preferential absorption of pollutants from the air stream to scrubbant solution for collection, treatment, and disposal. Oxidation/Reduction scrubbing (O/R) facilitate the removal of NO_2 through the use of a caustic scrubbant or ozone injection. Scrubbers are more commonly employed for use in controlling low dust loadings or soluble inorganic vapors.

Based upon review of the RBLC and contact with state agencies, scrubbers have not been employed as a pollution control device for NO_x emissions from lime kilns. A vendors have reported an EDV Wet scrubbing system capable of achieving a >99% reduction in NO_x from process heaters with flow rates up to 500,000 cubic feet per minute within the NEET database. Theoretical NO_x removal efficiencies of 90 percent for O/R scrubbing has been reported by manufacturers of the control equipment.

O/R Scrubbing is based upon several stages which include the following:

- Cooling of flue gases to the dew point temperature (approximately 150 to 250^{o}F) to condense water vapor from the exhaust stream.
- Injection of ozone or sodium chlorite into a reaction chamber to cause a low temperature oxidation of NO_x to higher oxides.
- Higher oxides formed within the reaction chamber are removed by absorption using a caustic scrubbing system. A nitric acid solution is created as a byproduct.

Although NO_x may be removed from the post-ESP exhaust stream, the cooling of the exhaust stream will likely result in a visible plume with a potential to contain nitric acid. To prevent in-stack condensation of acid gases, the saturated flue gas must be heated to protect downstream equipment and ambient impacts.

Bowater has excluded the use of O/R scrubbing technology due to potential for damage to the process equipment, the generation of large quantities of acidic wastewater, and safety considerations regarding the storage and use of ozone. Furthermore, the heating of the flue gas post-scrubbing will result in added NO_x formation from fuel combustion in a NO_x non-attainment area.

5.3.2.3 Control Technology Cost Estimates

A cost analysis was not conducted to determine the cost effectiveness of equipment for NO_x controls. Bowater will install a pre-dryer as part of the proposed project that will use flue gas recirculation to preheat the incoming lime mud. Bowater has determined that other add-on control technologies are not technically feasible or appropriate for the control of NO_x emissions for the No. 2 lime kiln. No control efficiency may be attributed to the pre-dryer installation.

5.3.2.4 Selection of BACT

Bowater's Catawba Mill maintains the lowest NO_x emission rate on a parts per million basis for an existing kiln with the exception of the Popoe and Talbot Mill. The Pope and Talbot BACT limit of 112 ppm is not achievable based upon recent test data (2003 and 2004) at the Catawba Mill that resulted in NOx emissions from the No. 2 lime kiln at 128 and 76 ppm at 10% oxygen. Therefore, Bowater is not confident that the No. 2 lime kiln cannot demonstrate continuous compliance with a 112 ppm BACT/LAER limit following the proposed project. Furthermore, the Pope and Talbot lime kiln processes 220 tons of CaO per day, while the Bowater modification results in CaO processing at levels almost 3 times greater.

Bowater proposes to retain the existing 152 ppm NO_x BACT/LAER limit. The determination that BACT/LAER is good combustion control and the proposed limit of 152 ppm are consistent with SC Standard 5.2, which requires new lime kilns to employ either good combustion control or equivalent technology capable of achieving 175 ppm NO_x at 10% oxygen.

5.3.3 Particulate Matter less than Ten Microns

The 2001 BACT analysis for the No. 2 Lime Kiln established an electrostatic precipitator as BACT. The BACT emission limit from 2001 is 0.030 grains per dry standard cubic foot (gr/dscf) by volume (dry basis) at eight percent oxygen. Bowater currently utilizes an electrostatic precipitator to control PM_{10} emissions.

5.3.3.1 Demonstrated Control Technologies

Bowater has evaluated control technologies for PM_{10} emissions from lime kilns through the review of the RBLC database, the EPA NEET Clean Air Technologies Database, the South Coast Air Quality Management District's (AQMD) BACT Guidelines, and the EPA Clean Air Technology Center's technical bulletins or fact sheets. A summary of the PM_{10} BACT determinations for existing Lime Kilns are contained in Table 5.6.

Table 5.6
Summary of PM/PM_{10} RBLC Determinations
Existing Lime Kilns

RBLCID	FACILITY	CITY/COUNTY	ST	RATE	UNITS	CONTRL DESCRIPTION
FL-0058	GEORGIA-PACIFIC CORPORATION	PALATKA	FL	0.081	GR/DSCF @ 10% O2	WET SCRUBBER
FL-0087	CHAMPION INTERNATIONAL CORP	ESCAMBIA	FL	10.9	LB/HR	NONE LISTED
FL-0111	BUCKEYE FLORIDA, L.P.	TAYLOR	FL	0.0451 20	GR/DSCF @ 10% O2 LB/HR	ESP
GA-0064	RIVERWOOD INTERNATIONAL CORPORATION	MACON	GA	0.15 (0.042)	GR/DSCM @ 10% O2 (GR/DSCF @ 10% O2)	VENTURI SCRUBBER
LA-0122	INTERNATIONAL PAPER	MANSFIELD	LA	39.2	LB/HR	VENTURI SCRUBBER
LA-0155	CROWN PAPER COMPANY-ST. FRANCISVILLE MILL	WEST FELICIANA PARISH	LA	7.35	LB/HR	NONE LISTED (NOT BACT)
LA-0174	GEORGIA-PACIFIC CORPORATION- PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	0.033 20.45	GR/DSCF @ 10% O2 LB/HR	ESP
LA-0174	GEORGIA-PACIFIC CORPORATION- PORT HUDSON OPERATIONS	EAST BATON ROUGE PARISH	LA	0.05 25.76	GR/DSCF @ 10% O2 LB/HR	WET SCRUBBER
ME-0030	LINCOLN PULP AND PAPER COMPANY, INCORPORATED	PENOBSCOT	ME	0.13 20.9	GR/DSCF @ 10% O2 LB/HR	WET SCRUBBER
MS-0029	WEYERHAEUSER COMPANY	COLUMBUS	MS	0.033	GR/DSCF @ 10% O2	ESP (NOT BACT)
NC-0092	INTERNATIONAL PAPER COMPANY RIEGELWOOD MILL	COLUMBUS	NC	0.13	GR/DSCF @ 10% O2	ESP AND WET VENTURI SCRUBBER
SC-0015	WILLAMETTE INDUSTRIES	MARLBORO	SC	0.054	GR/DSCF @ 10% O2	ESP
SC-0045	WILLAMETTE INDUSTRIES - MARLBORO MILL	MARLBORO	SC	0.033 10.04	GR/DSCF @ 10% O2 LB/HR	ESP
SC-0084	BOWATER	YORK	SC	0.03	GR/DSCF @ 10% O2	ESP
TX-0263	DONAHUE INDUSTRIES, INC.	ANGELINE	TX	22.7	LB/HR	SCRUBBER
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	0.030 34	GR/DSCF @ 10% O2 TPY	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	0.030 20	GR/DSCF @ 10% O2 TPY	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	0.035 0.06	GR/DSCF @ 10% O2 NG GR/DSCF @ 10% O2 oil	NONE LISTED (NOT BACT)
WA-0303	LONGVIEW FIBER COMPANY	OLYMPIA	WA	0.030 35.6	GR/DSCF @ 10% O2 TPY	NONE LISTED (NOT BACT)

Of the BACT determinations listed within the RBLC for existing lime kilns, the selected pollution control measures were electrostatic precipitators and scrubbers. The range of emission limits for existing kilns with ESP's that have been modified is 0.030 to 0.15 gr/dscf, with a median of 0.033 gr/dscf. The most recent BACT determination is 0.033 gr/dscf for the lime kiln at the Georgia-Pacific Port Hudson mill in East Baton Rouge Parish, Louisiana.

The lowest emission limit within the RBLC is 0.030 grains per dry standard cubic feet, which is equivalent to the existing PM_{10} BACT limit for the lime kiln at Bowater's Catawba Mill. Therefore, as the current ESP achieves a control efficiency equal to or greater than other

available PM control measures (e.g., fabric filter or wet scrubber) and the Bowater Catawba Mill's current BACT limit represents the lowest BACT limit in the RBLC, further control technology analysis was not conducted.

5.3.3.2 Selection of BACT

Fabric filters and baghouses can achieve PM_{10} removal efficiencies similar to ESP's. However, the use of fabric filters/baghouses for PM_{10} removal are not technically feasible due to the high moisture content of the gas stream and hygroscopic salts (particulates) in the flue gas, which would very quickly "blind" the collection bags. Wet scrubbers are generally not as efficient as ESP's at removing PM_{10}, are not considered BACT for the lime kilns. Therefore, an electrostatic precipitator is BACT.

The No. 2 lime kiln utilizes an electrostatic precipitator to minimize PM emissions. The No. 2 lime kiln emission rate meets the MACT Subpart MM limit of 0.064 gr/dscf by volume at 10% oxygen when firing natural gas or No. 6 fuel oil. The existing PM limit, 0.03 gr/dscf, represents the lowest emission limit in the RBLC for existing lime kilns. Therefore, Bowater proposes to retain the existing 0.03 gr/dscf limit as BACT for the proposed modifications.

6.0 Air Quality Impact Analysis

Air dispersion modeling analyses for Class II areas around the facility will be prepared and submitted to DHEC under separate cover, following review and approval of an air dispersion modeling protocol. Similarly, air dispersion modeling for appropriate PSD Class I areas will be discussed with the appropriate Federal Land Manager(s) and submitted under separate cover. DHEC will be provided with copies of PSD Class I area modeling and correspondence with the FLM(s).

7.0 Additional Impacts Analysis

7.1 Growth

The proposed changes to the facility will not result in any significant growth. The site has been operating for over forty years. The proposed modifications will not add to employment at the site. The increased fiberline production will result in slightly more wood and chemical shipments to the facility and paper products shipments from the site. However, since much of the paper and chemicals are shipped by rail, the secondary emissions associated with shipments to and from the site are not expected to increase significantly. Therefore, no significant growth impacts are expected from the proposed project.

7.2 Soils and Vegetation

There are not expected to be any significant impacts to soils or vegetation from the proposed changes at the facility. Air quality modeling analyses submitted in support of this application will be required to demonstrate attainment of all applicable National Ambient Air Quality Standards and Prevention of Significant Deterioration air quality increments. Since these standards and increments are based on protection of the environment, no significant impacts to soils or vegetation are expected.

7.3 Visibility

The proposed emission increases of PM_{10}, SO_2, NO_X, and CO are less than ten percent of allowable emissions levels from the facility. Therefore, no significant visibility impacts are expected from the proposed project. York County is located within a non-attainment area for ozone. Since NO_x represents a reactant in the formation of ground level ozone, Bowater has lowered NO_x emissions through offsets. As a result of NO_x offsets, visibility may actually improve due to decreased smog formation.

APPENDIX A

Application Forms

D H E C
PROMOTE PROTECT PROSPER

Part I Permit Application Form
Bureau of Air Quality

Please Refer To Instructions On Back Before Completing This Form

1. Air Permit Number for Existing Plant: **2440-0005**
2. Company Name for Permit: **Bowater Coated Paper Division**
3. Mailing Address: **P.O. Box 7**

   City: **Catawba** State: **SC** Zip Code: **29704**
4. Plant Location (Street or Highway) **5300 Cureton Ferry Road**

   City: **Catawba** State: **SC** Zip Code: **29704** County: **York**
5. Person to Contact: **Dale L. Herendeen** Phone No. **803 981-8009**
6. Standard Industrial Classification (SIC) Code for Plant: **2611**
7. Attach the following applicable part(s) for each emission source:
   - A. Number of Fuel Burning Applications (Part IIA):
   - B. Number of Process Applications (Part IIB): **9**
   - C. Number of Incinerator Applications (Part IIC):
   - D. Number of Asphalt Plant Applications (Part IID):
   - E. Number of Dry Cleaner Applications (Part IIE):
   - F. Number of Concrete Batch Plant Permit Applications (Part IIF):
   - G. Number of Storage Vessel Permit Applications (Part IIG/Part IIGa) **1**
8. Application Type ☐ Operating Renewal Existing Sources Construction Date:

   ☒ NEW Construction Start Date: **March 2006** Finish Date: **April 2007**
9. Signatures:

I certify, to the best of my knowledge and belief, that no undseriable levels of air pollutants will be created and no applicable standards and/or regulations will be contravened or violated. I understand that any statements and/or descriptions which are found to be incorrect may result in the immediate revocation of any permit issued pursuant to this application.

Company Official Signature | Title/Position | Date

I have placed my signature and seal on the engineering documents submitted, signifying that I accept responsibility for the accuracy of this application as it pertains to DHEC Air Pollution Regulation 61-62.

Professional Engineer Signature | S.C. Registration No. | Date

If the consultant or professional engineer that prepared this application desires a copy of issued permit(s), please complete the information below.

Name/Consulting Firm: **URS Corporation**

Address: **11 Brendan Way, Suite 140** City: **Greenville**

State: **South Carolina** Zip Code: **29615** Phone No.: **(864) 609-9111**

*****INCOMPLETE APPLICATIONS WILL BE RETURNED*****

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Kraft Mill Pulping System (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Kraft Mill Fiberline**

2. Major Raw Materials **Wood** Quantity Used: **2,566,200 tons/year**

   Products: **Kraft pulp (unbleached)** Rated Production: **666,125 tons/yr**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **HVLC system and LVHC system incinerated in Combination Boilers No. 1 & No. 2**

5. Stack Data:

Height Above Ground	**N/A**	ft.	Gas Velocity	**N/A**	ft/.sec
Inside Diameter	**N/A**	ft.	Temperature	**N/A**	°F
Est. Moisture	**N/A**	%	Location (UTM or Lat./Long)	**N/A**	

6. Emission Rate at rated capacity (lb/hr.): **HVLC & LVHC emissions only (vented at combination boilers)**

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**N/A**	**N/A**	**N/A**
SO_2	**0***	**45****	**Engineering Estimate**
CO	**N/A**	**3.4****	**Engineering Estimate**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**133**	**2.6**	**Engineering Estimate**
Other (specify):			
Total HAPs (Methanol)	**104**	**2.1**	**Engineering Estimate**
TRS (as S)	**23**	**0***	**Engineering Estimate**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   N/A

* Sulfur contained in TRS compounds incinerated in combination boilers is converted to SO_2.

** Emissions resulting from HVLC & LVHC (TRS) incineration only, does not include emissions from fuel combustion.

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Kraft Mill Bleaching System (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Kraft Mill Bleach Plant**

2. Major Raw Materials **Kraft pulp (unbleached)** Quantity Used: **666,125 tons/yr**

   Products: **Kraft pulp (bleached)** Rated Production: **639,480 tons/yr**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **Scrubber**

5. Stack Data:

   Height Above Ground **N/A** ft. Gas Velocity **N/A** ft/.sec

   Inside Diameter **N/A** ft. Temperature **N/A** °F

   Est. Moisture **N/A** % Location (UTM or Lat./Long) **N/A**

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**N/A**	**N/A**	**N/A**
SO_2	**N/A**	**N/A**	**N/A**
CO	**61.0**	**61.0**	**Engineering Estimate**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**3.4**	**3.4**	**Engineering Estimate**
Other (specify):			
Total HAPs (Methanol)	**9.5**	**9.5**	**Engineering Estimate**
TRS (as S)	**0.20**	**0.20**	**Engineering Estimate**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Not Applicable

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Kraft Pulp Mill Evaporator Set No. 1 (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Kraft Pulp Mill Evaporator Set No. 1**

2. Major Raw Materials **Kraft pulp (unbleached)** Quantity Used: **278,393 tons BLS/yr**

   Products: **Kraft pulp (unbleached)** Rated Production: **278,393 tons BLS/yr**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **LVHC system (including caustic scrubber) and Combination Boilers No. 1 & No. 2**

5. Stack Data:

Height Above Ground	**N/A**	ft.	Gas Velocity	**N/A**	ft/.sec
Inside Diameter	**N/A**	ft.	Temperature	**N/A**	°F
Est. Moisture	**N/A**	%	Location (UTM or Lat./Long)	**N/A**	

6. Emission Rate at rated capacity (lb/hr.): **LVHC system emissions only (vented at combination boilers)**

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**N/A**	**N/A**	**N/A**
SO_2	**0****	**42.4**	**Source test**
CO	**N/A**	**N/A**	**N/A**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**12.7**	**0.25**	**Source test**
Other (specify):			
Total HAP's (methanol)	**12.7**	**0.25**	**Source test**
TRS (as S)	**84.7**	**0****	**Source test**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Not applicable

* Sulfur contained in TRS compounds incinerated in combination boilers is converted to SO_2.

** Emissions resulting from HVLC & LVHC (TRS) incineration only, does not include emissions from fuel combustion.

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Recovery Furnace No. 3 (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Recovery Furnace No. 3**

2. Major Raw Materials **Black Liquor Solids** Quantity Used: **744,600 tons/year**

   Products: **Smelt** Rated Production: **Varies**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
Natural Gas	**1,050 Btu/cf**	**Not Applicable**	**Not Applicable**	**352,381 cf/hr**
No. 6 Fuel Oil	**150,000 Btu/gal**	**2.5**	**0.1**	**40 gpm**

4. Air Pollution Control Device Description: **Electrostatic Precipitator**

5. Stack Data:

   Height Above Ground **225** ft. Gas Velocity **52** ft/.sec

   Inside Diameter **11** ft. Temperature **320** °F

   Est. Moisture **24** % Location (UTM or Lat./Long) **510.9 E, 3855.6 N**

6. Emission Rate at rated capacity (lb/hr.): **Black liquor solids firing emissions only**

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**18,171***	**78.1**	**BACT Limit**
SO_2	**127**	**127**	**BACT Limit**
CO	**331**	**331**	**Engineering Est.**
NO_x	**146**	**146**	**BACT/LAER Limit**
VOC's	**7.7**	**7.7**	**Engineering Estimate**
Other (specify):			
TRS (as S)	**5.6**	**5.6**	**NSPS Limit**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

* assumes 10 gr/dscf uncontrolled.

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **No. 3 Smelt Dissolving Tank (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **No. 3 Smelt Dissolving Tank**

2. Major Raw Materials **Smelt** Quantity Used: **Varies**

   Products: **Green liquor** Rated Production: **1,168,900 gal/day**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **Venturi scrubber**

5. Stack Data:

   Height Above Ground **218** ft. Gas Velocity **29** ft/.sec

   Inside Diameter **6** ft. Temperature **148** °F

   Est. Moisture **Unknown** % Location (UTM or Lat./Long) **510.9 E, 3855.6 N**

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**773***	**17**	**NSPS Limit**
SO_2	**0.43**	**0.43**	**Engineering Estimate**
CO	**N/A**	**N/A**	**N/A**
NO_x	**1.7**	**1.7**	**Engineering Estimate**
VOC's	**0.85**	**0.85**	**Engineering Estimate**
Other (specify):			
TRS (as S)	**2.8**	**2.8**	**NSPS Limit**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

* assumes 97.8% control.

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **No. 3 Precipitator Mix Tank (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **No. 3 Precipitator Mix Tank**

2. Major Raw Materials **Black liquor solids** Quantity Used: **2040 tons/day**

   Products: **Black liquor solids** Rated Production: **2040 tons/day**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **None**

5. Stack Data:

   Height Above Ground **N/A** ft. Gas Velocity **N/A** ft/.sec

   Inside Diameter **N/A** ft. Temperature **N/A** °F

   Est. Moisture **N/A** % Location (UTM or Lat./Long) **N/A**

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**N/A**	**N/A**	**N/A**
SO_2	**N/A**	**N/A**	**N/A**
CO	**N/A**	**N/A**	**N/A**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**0.11**	**0.11**	**Engineering Estimate**
Other (specify):			
Total Reduced Sulfur	**0.0085**	**0.0085**	**Engineering Estimate**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Causticizing Area Equipment (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Causticizing**

2. Major Raw Materials **Reburned lime** Quantity Used: **219,000 tons/yr**

   Products: **White liquor** Rated Production: **1,422 gal/min**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **Scrubber (salker and causticizers), 2 baghouses (lime silos)**

5. Stack Data:

   Height Above Ground **N/A** ft. Gas Velocity **N/A** ft/.sec

   Inside Diameter **N/A** ft. Temperature **N/A** °F

   Est. Moisture **N/A** % Location (UTM or Lat./Long) **N/A**

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**189***	**1.89**	**Engineering Estimate**
SO_2	**N/A**	**N/A**	**N/A**
CO	**N/A**	**N/A**	**N/A**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**4.0**	**4.0**	**Engineering Estimate**
Other (specify):			
Total Reduced Sulfur	**0.088**	**0.088**	**Engineering Estimate**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

* assumes 99% control.

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Lime Kiln No. 2 (PRODUCTION INCREASE)**

   Process SIC Code: **2611**

   Process Unit Designation **Lime Kiln No. 2**

2. Major Raw Materials **Lime mud** Quantity Used: **Varies**

   Products: **Reburned lime** Rated Production: **219,000 tons/yr**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **Electrostatic precipitator**

5. Stack Data:

Height Above Ground	**184**	ft.	Gas Velocity	**46**	ft/.sec
Inside Diameter	**6**	ft.	Temperature	**500**	°F
Est. Moisture	**33**	%	Location (UTM or Lat./Long)	**511.1E, 3855.6N**	

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**10,200***	**20.4**	**BACT Limit**
SO_2	**39.4**	**39.4**	**BACT Limit**
CO	**24.3**	**24.3**	**Engineering Estimate**
NO_x	**86.7**	**86.7**	**BACT Limit**
VOC's	**0.58**	**0.58**	**Engineering Estimate**
Other (specify):			
Total Reduced Sulfur	**2.0**	**2.0**	**NSPS Limit**

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

* assumed ESP efficiency of 99.8%

D H E C
PROMOTE PROTECT PROSPER

Process Permit Application
Bureau of Air Quality
Part IIB

1. Company Name **Bowater Coated Paper Division**

   Process Description: **Woodyard Dumper (EXEMPTION REQUESTED)**

   Process SIC Code: **2611**

   Process Unit Designation **Woodyard Dumper**

2. Major Raw Materials **Wood chips** Quantity Used: **120 tons/hr**

   Products: **Wood chips** Rated Production: **120 tons/hr**

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
N/A				

4. Air Pollution Control Device Description: **None**

5. Stack Data:

   Height Above Ground **N/A** ft. Gas Velocity **N/A** ft/.sec

   Inside Diameter **N/A** ft. Temperature **N/A** °F

   Est. Moisture **N/A** % Location (UTM or Lat./Long) **N/A**

6. Emission Rate at rated capacity (lb/hr.):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	**0.24**	**0.24**	**Engineering Estimate**
SO_2	**N/A**	**N/A**	**N/A**
CO	**N/A**	**N/A**	**N/A**
NO_x	**N/A**	**N/A**	**N/A**
VOC's	**N/A**	**N/A**	**N/A**
Other (specify):			

7. Are any of the collected materials subject to the provisions of the S.C. Hazardous Waste Management Act or Regulations? (specify): **Not Applicable**

8. Normal Operating Schedule: **24** hours/day **7** days/week **52** weeks/year

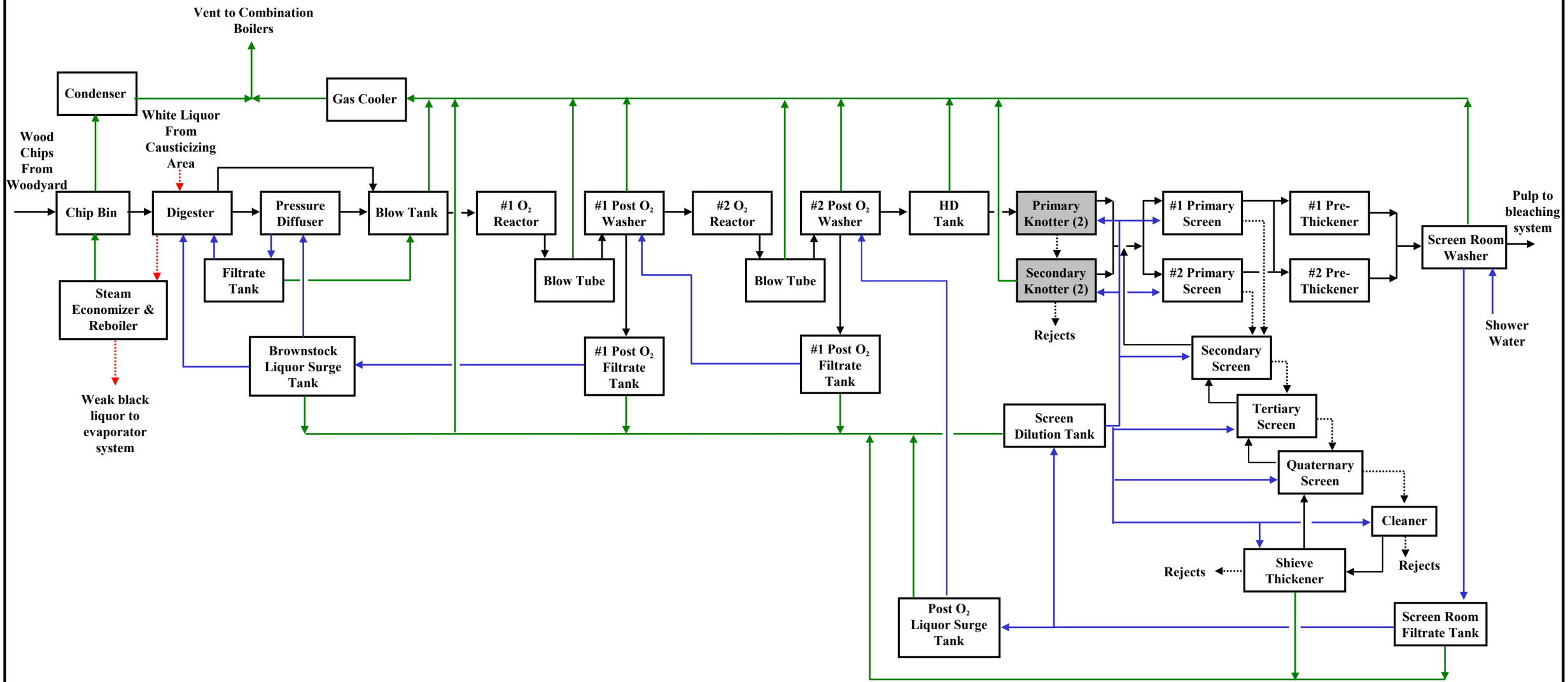
   Seasonal Variation: Dec.-Feb. **25** % Mar.-May **25** % June-Aug. **25** % Sept.-Nov. **25** %

9. How will waste material from process and control equipment be disposed of?

   Recycled to process

APPENDIX B

Process Flow Diagrams



Legend

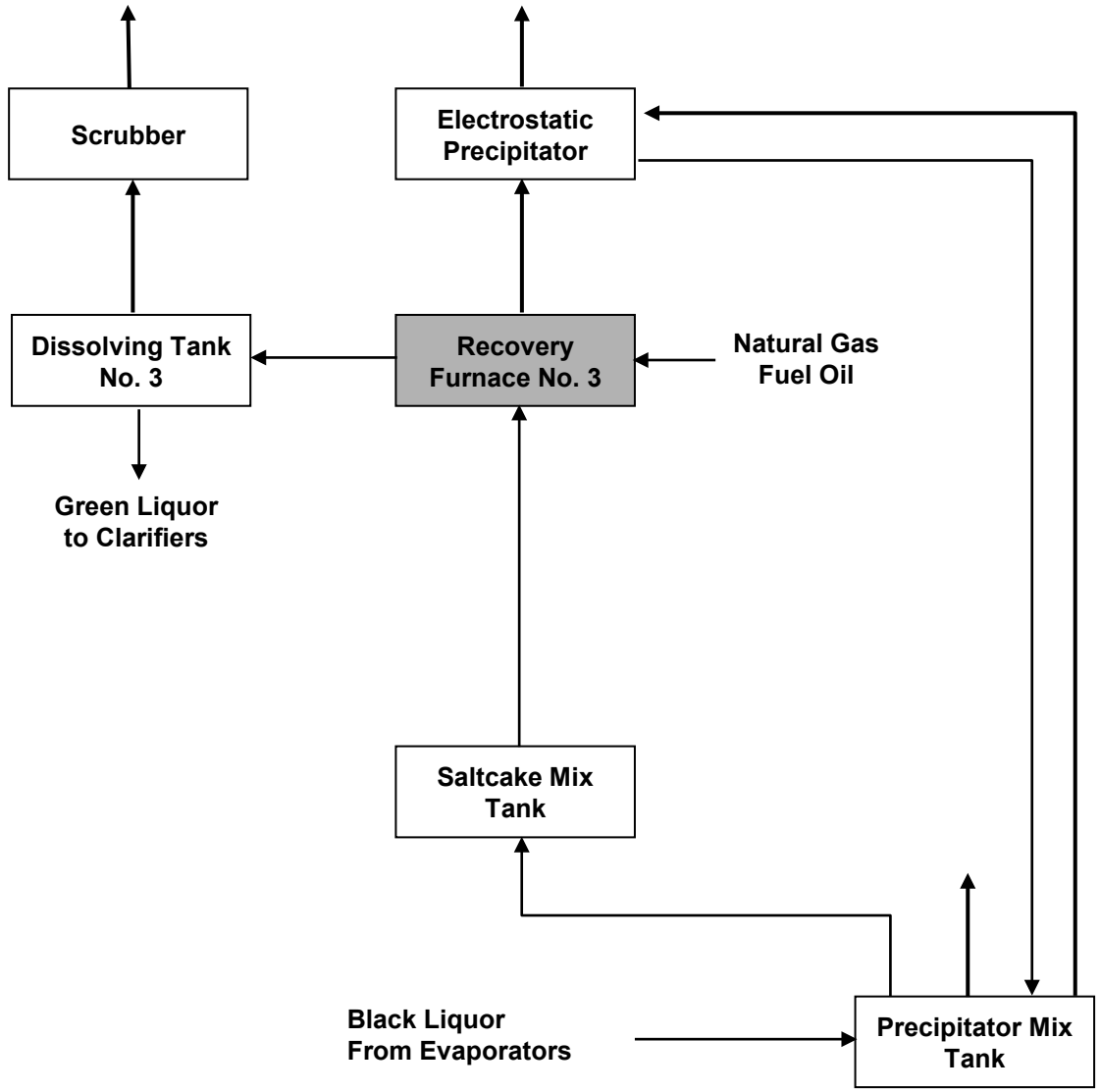
- Pulp
- Air
- Water (Shower)
- Liquor
- Rejects

Modified Emission Unit

Note: This is a simplified process flow diagram based on preliminary design information.

BOWATER

Figure B-1
Pulping System
Bowater Coated and Specialty Papers Division
Catawba, South Carolina



Legend

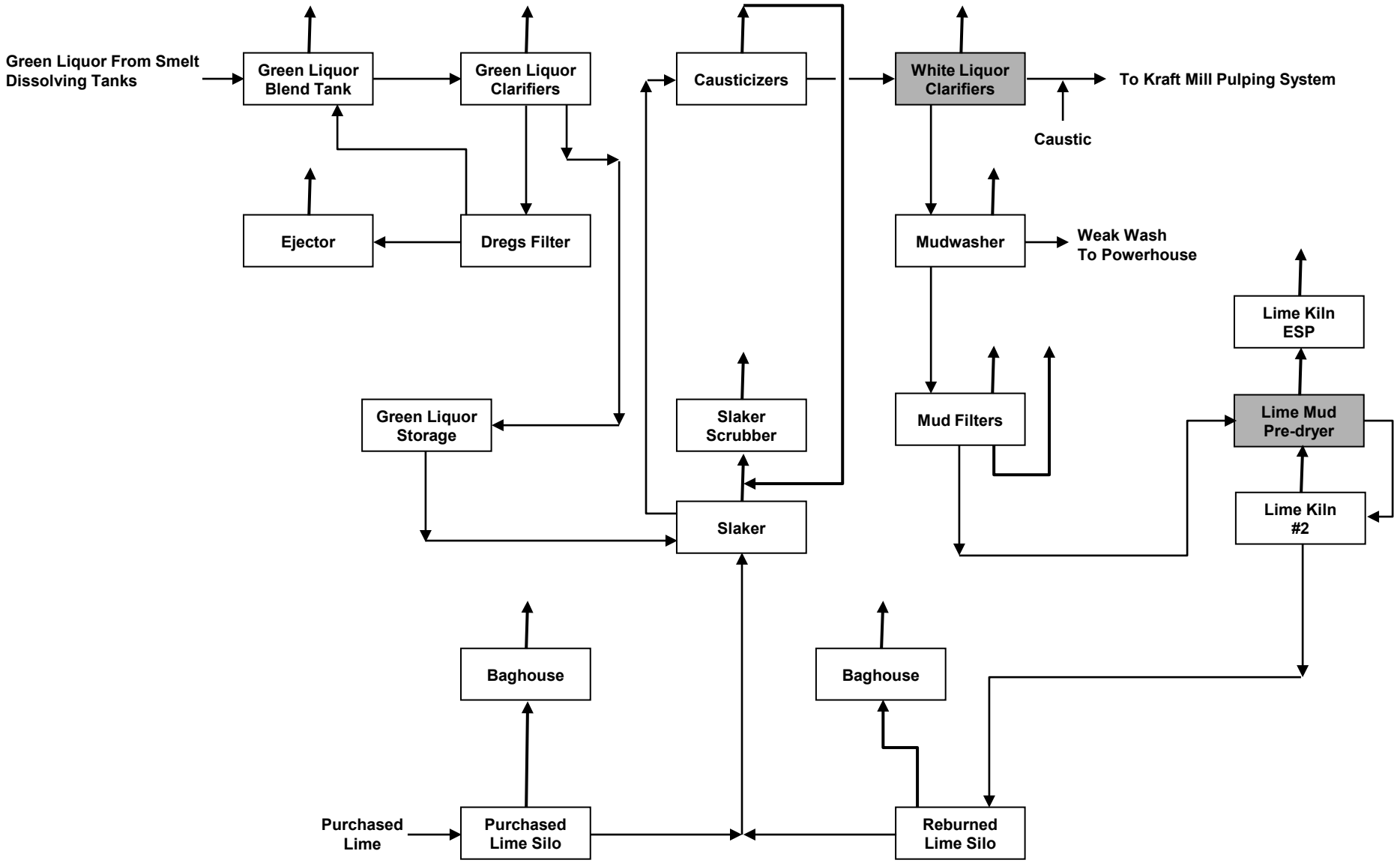
Process Flow

Air Emissions

Modified Emission Unit

BOWATER

Figure B-3
No. 3 Recovery Furnace
Bowater Coated and Specialty Papers Division
Catawba, South Carolina



Legend

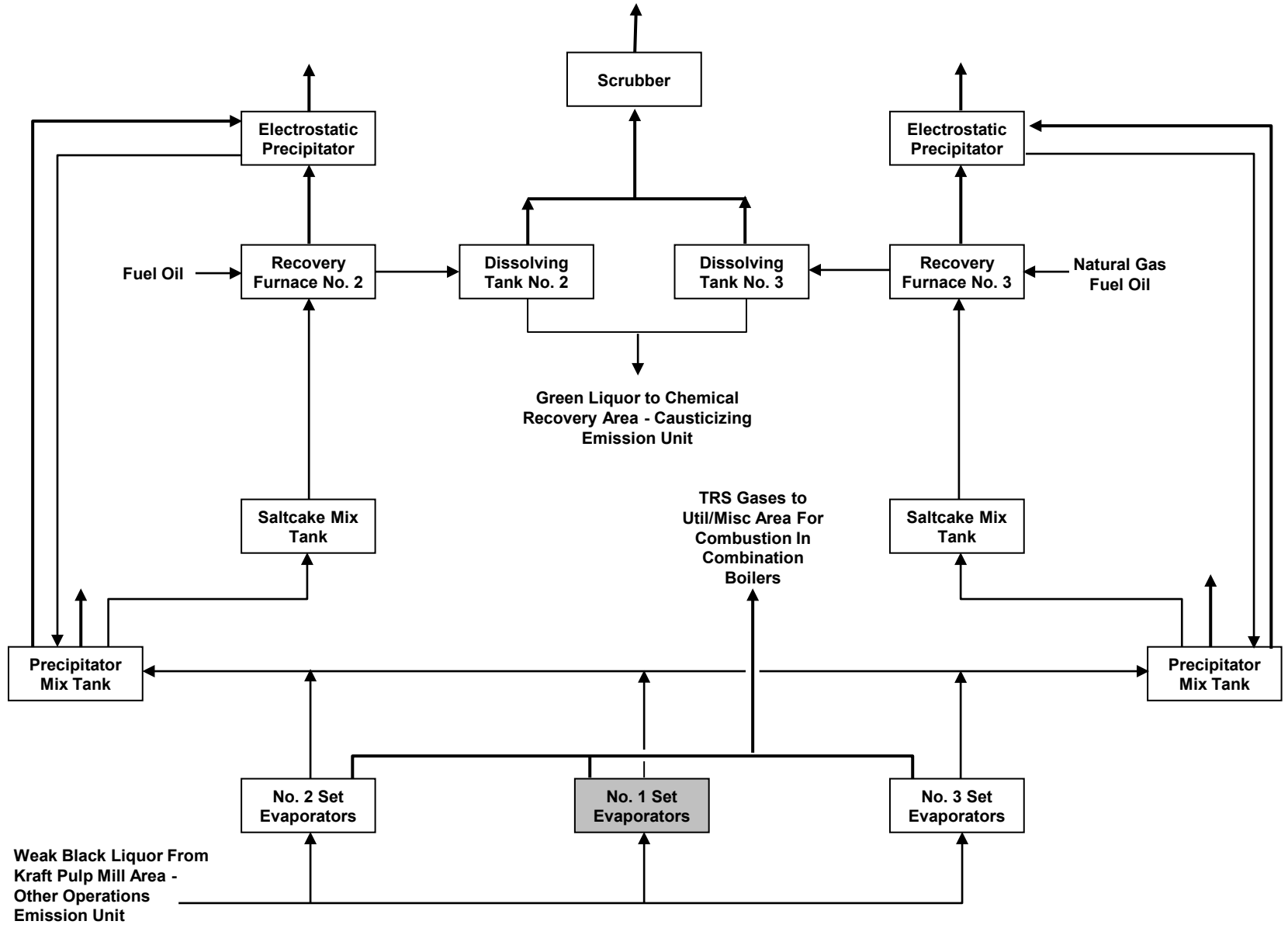
Process Flow

Air Emissions

Modified / New Emission Unit

BOWATER

Figure B-4
Causticizing Area
Bowater Coated and Specialty Papers Division
Catawba, South Carolina



Legend

Process Flow

Air Emissions

Modified Emission Unit

BOWATER

Figure B-2
Evaporator Sets
Bowater Coated and Specialty Papers Division
Catawba, South Carolina

APPENDIX C

Emissions Calculations

Kraft Pulping System

C.1 Kraft Mill Continuous Digester Chip Bin (HVLC System)

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.1.1 Sulfur Dioxide (SO_2) Emissions

Emission factor from NCASI TB 858 for total TRS (as S) = 1.5E-01 lb/ADTUP (live steam)

Combination boiler TRS to SO_2 conversion efficiency = 100%

Emission factor = 1.5E-01 lb S/ADTUP × 64 lb SO_2/32 lb S = 0.30 lb SO_2/ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 0.30 lb/ADTP × 1 day/24 hr = 21 lbs/hr

610,000 ADTUP/yr × 0.30 lb/ADTP × 1 ton/2,000 lb = 92 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.30 lb/ADTP × 1 day/24 hr = 23 lbs/hr

666,125 ADTUP/yr × 0.30 lb/ADTP × 1 ton/2,000 lb = 100 tons/yr

C.1.2 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884 = 0.46 lb/ton chip

Combination boiler destruction efficiency = 98%

Assume 50% yield, 1 ton chip = 0.5 ton ADTUP

Emission factor = 0.46 lb/ton chips × 1 ton chips/0.5 ADTP = 0.92 lb/ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 0.92 lb/ADTUP × 1 day/24 hr × (1 - 0.98) = 1.3 lbs/hr

610,000 ADTUP/yr × 0.92 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 5.6 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.92 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 1.4 lbs/hr

666,125 ADTUP/yr × 0.92 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 6.1 tons/yr

C.1.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858 = 1.5E-02 lb/ADTUP

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 1.5E-02 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 2.1E-02 lb/hr

610,000 ADTUP/yr × 1.5E-02 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 9.2E-02 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 1.5E-02 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 2.3E-02 lb/hr

666,125 ADTUP/yr × 1.5E-02 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 1.0E-01 tons/yr

C.2 Kraft Mill Continuous Digester & Blow Tank (HVLC System)

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.2.1 Sulfur Dioxide (SO_2) Emissions

Emission factors from NCASI TB 858 for total TRS (as S):

Blow Gases = 1.9E-02 lb/ADTUP

Relief Gases = 4.2E-02 lb/ADTUP

TOTAL = 0.061 lb/ADTUP

Combination boiler TRS to SO_2 conversion efficiency = 100%

Emission factor = 0.061 lb S/ADTUP × 64 lbs SO_2/32 lb S = 0.122 lb SO_2/ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 0.122 lb/ADTP × 1 day/24 hr = 8.5 lbs/hr

610,000 ADTUP/yr × 0.122 lb/ADTP × 1 ton/2,000 lb = 37 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.122 lb/ADTP × 1 day/24 hr = 9.3 lbs/hr

666,125 ADTUP/yr × 0.122 lb/ADTP × 1 ton/2,000 lb = 41 tons/yr

C.2.2 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884 = 0.71 lb/ADTUP (Pulping & Evaporator)

Methanol emission factors from NCASI TB 858:

Evaporator Only = 0.022 lb/ADTUP

Pulping + Evaporator = 0.043 lb/ADTUP

Combination boiler destruction efficiency = 98%

VOC Emission factor = 0.71 lb/ADTUP × [(0.043 – 0.022) ÷ 0.043] lb/ADTUP = 0.35 lb/ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 0.35 lb/ADTUP × 1 day/24 hr × (1 - 0.98) = 0.49 lb/hr

610,000 ADTUP/yr × 0.35 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 2.1 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.35 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.53 lb/hr

666,125 ADTUP/yr × 0.35 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 2.3 tons/yr

C.2.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858:

Blow Gases = 7.9E-03 lb/ADTUP

Relief Gases = 1.4E-03 lb/ADTUP

TOTAL = 9.3E-03 lb/ADTUP

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 9.3E-03 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.013 lb/hr

610,000 ADTUP/yr × 9.3E-03 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.057 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 9.3E-03 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.014 lb/hr

666,125 ADTUP/yr × 9.3E-03 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.062 ton/yr

C.3 Kraft Mill Turpentine Recovery System (LVHC System)

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.3.1 Sulfur Dioxide (SO_2) Emissions

Emission factors from NCASI TB 858 for total TRS (as S) = 3.0E-03 lb/ADTUP

Combination boiler TRS to SO_2 conversion efficiency = 100%

LVHC caustic scrubber TRS removal efficiency = 50%

Emission factor = 3.0E-03 lb S/ADTUP × 64 lb SO_2/32 lb S × (1 - 0.50) = 3.0E-03 lb SO_2 /ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 3.0E-03 lb/ADTUP × 1 day/24 hr = 0.21 lb/hr

610,000 ADTUP/yr × 3.0E-03 lb/ADTUP × 1 ton/2,000 lb = 0.92 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 3.0E-03 lb/ADTUP × 1 day/24 hr = 0.23 lb/hr

666,125 ADTUP/yr × 3.0E-03 lb/ADTUP × 1 ton/2,000 lb = 1.0 ton/yr

C.3.2 Volatile Organic Compound (VOC) Emissions

Assume VOC = methanol

Emission factor from NCASI TB 858: Methanol = 9.2E-04 lb/ADTUP

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 day/24 hr = 0.0013 lb/hr

610,000 ADTUP/yr × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 ton/2,000 lb = 0.0056 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 day/24 hr = 0.0014 lb/hr

666,125 ADTUP/yr × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 ton/2,000 lb = 0.0061 ton/yr

C.3.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858 = 9.2E-04 lb/ADTUP

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 day/24 hr = 0.0013 lb/hr

610,000 ADTUP/yr × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 ton/2,000 lb = 0.0056 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 day/24 hr = 0.0014 lb/hr

666,125 ADTUP/yr × 9.2E-04 lb/ADTP × (1 - 0.98) × 1 ton/2,000 lb = 0.0061 ton/yr

C.4 Kraft Mill Pressure Diffusion Washer

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.4.1 Sulfur Dioxide (SO_2) Emissions

Emission Factor from NCASI TB 858 for total TRS (as S) = 3.6E-02 lb/ADTUP

3.6E-02 lb S/ADTUP × 64 lb SO_2/32 lb S = 7.2E-02 lb SO_2 /ADTUP

Combination boiler TRS to SO_2 conversion efficiency = 100%

Baseline actual emissions:

1,675 ADTUP/day × 7.2E-02 lb/ADTP × 1 day/24 hr = 5.0 lbs/hr

610,000 ADTUP/yr × 7.2E-02 lb/ADTP × 1 ton/2,000 lb = 22 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 7.2E-02 lb/ADTP × 1 day/24 hr = 5.5 lbs/hr

666,125 ADTUP/yr × 7.2E-02 lb/ADTP × 1 ton/2,000 lb = 24 tons/yr

C.4.2 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884 = 0.13 lb/ADTP

Control efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 0.13 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.18 lb/hr

610,000 ADTUP/yr × 0.13 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.79 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 0.13 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.20 lb/hr

666,125 ADTUP/yr × 0.13 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.87 ton/yr

C.4.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858 = 0.081 lb/ADTP

Control efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 0.081 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.11 lb/hr

610,000 ADTUP/yr × 0.081 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.49 ton/yr

Projected actual emissions:

1,825 ADTUP/day × 0.081 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.12 lb/hr

666,125 ADTUP/yr × 0.081 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 0.54 ton/yr

C.5 Kraft Mill Knotting and Screening

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.5.1 Sulfur Dioxide (SO_2) Emissions

Emission factors from NCASI TB 858 for total TRS (as S):

Knotters = 1.3E-03 lb/ODTUP

Screens = 9.0E-04 lb/ODTUP

Deckers = 3.5E-02 lb/ADTUP

Pulp Storage Tanks = 4.2E-01 lb/hr/tank

Total TRS = [(1.3E-03 + 9.0E-04) lb/ODTUP × (0.9 ODT/1.0 ADT)] + 3.5E-02 lb/ADTUP + (4.2E-01 lb/hr/tank × 1 tank)

Total TRS = 3.70E-02 lb/ADTUP + 4.2E-01 lb/hr

Combination boiler TRS to SO_2 conversion efficiency = 100%

Emission factor = (3.70E-02 lb S/ADTUP + 4.2E-01 lb S/hr) × 64 lb SO_2/32 lb S = 7.40E-02 lb SO_2 /ADTUP + 8.4E-01 lb SO_2/hr

Baseline actual emissions:

(1,675 ADTUP/day × 7.40E-02 lb/ADTP × 1 day/24 hr) + 8.4E-01 lb/hr = 6.0 lbs/hr

[(610,000 ADTUP/yr × 7.40E-02 lb/ADTP) + (8.4E-01 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb = 26 tons/yr

Projected actual emissions:

(1,825 ADTUP/day × 7.40E-02 lb/ADTP × 1 day/24 hr) + 8.4E-01 lb/hr = 6.5 lbs/hr

[(666,125 ADTUP/yr × 7.40E-02 lb/ADTP) + (8.4E-01 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb = 28 tons/yr

C.5.2 Volatile Organic Compound (VOC) Emissions

Emission factors from NCASI TB 884:

Knotters = 0.005 lb/ODTUP

Screens = 0.004 lb/ODTUP

Deckers = 0.077 lb/ADTUP

Pulp Storage Tanks = 4.84 lbs/hr/tank

Emission Factor = [(0.005 + 0.004) lb/ODTUP × (0.9 ODT/1.0 ADT)] + 0.077 lb/ADTUP +
(4.84 lbs/hr/tank × 1 tank)

Emission Factor = 8.5E-02 lb/ADTUP + 4.84 lb/hr

Control efficiency = 98%

Baseline actual emissions:

[(1,675 ADTUP/day × 8.5E-02 lb/ADTUP × 1 day/24 hr) + 4.84 lb/hr] × (1 - 0.98) = 0.2 lb/hr

[(610,000 ADTUP/yr × 8.5E-02 lb/ADTUP) + (4.84 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb
× (1 - 0.98) = 0.9 ton/yr

Projected actual emissions:

[(1,825 ADTUP/day × 8.5E-02 lb/ADTUP × 1 day/24 hr) + 4.84 lb/hr] × (1 - 0.98) = 0.2 lb/hr

[(666,125 ADTUP/yr × 8.5E-02 lb/ADTUP) + (4.84 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb
× (1 - 0.98) = 1.0 ton/yr

C.5.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factors from NCASI TB 858:

Knotters = 2.5E-02 lb/ODTUP

Screens = 2.3E-01 lb/ODTUP

Deckers = 3.5E-02 lb/ADTUP

Pulp Storage Tanks = 4.9E-01 lb/hr/tank

Emission Factor = [(2.5E-02 + 2.3E-01) lb/ODTUP × (0.9 ODT/1.0 ADT)]
+ 3.5E-02 lb/ADTUP + (4.9E-01 lb/hr/tank × 1 tank)

Emission Factor = 2.65E-01 lb/ADTUP + 4.9E-01 lb/hr

Control efficiency = 98%

Baseline actual emissions:

[(1,675 ADTUP/day × 2.65E-01 lb/ADTUP × 1 day/24 hr) + 4.9E-01 lb/hr] × (1 - 0.98)
= 0.38 lb/hr

[(610,000 ADTUP/yr × 2.65E-01 lb/ADTUP) + (4.9E-01 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb
× (1 - 0.98) = 1.7 tons/yr

Projected actual emissions:

[(1,825 ADTUP/day × 2.65E-01 lb/ADTUP × 1 day/24 hr) + 4.9E-01 lb/hr] × (1 - 0.98)
= 0.41 lb/hr

[(666,125 ADTUP/yr × 2.65E-01 lb/ADTUP) + (4.9E-01 lb/hr × 8,760 hr/yr)] × 1 ton/2,000 lb
× (1 - 0.98) = 1.8 tons/yr

C.6 Kraft Mill Oxygen Delignification

Baseline actual production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Projected actual production = future maximum production = 1,825 ADTUP/day and 666,125 ADTUP/yr

C.6.1 Sulfur Dioxide (SO_2) Emissions

Emission factor from NCASI TB 858 for total TRS (as S) = 5.8E-03 lb/ADTUP

Combination boiler TRS to SO_2 conversion efficiency = 100%

Emission Factor = 5.8E-03 lb S/ADTUP × 64 lb SO_2/32 lb S = 1.16E-02 lb SO_2 /ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 1.16E-02 lb/ADTP × 1 day/24 hr = 0.81 lb/hr

610,000 ADTUP/yr × 1.16E-02 lb/ADTP × 1 ton/2,000 lb = 3.5 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 1.16E-02 lb/ADTP × 1 day/24 hr = 0.88 lb/hr

666,125 ADTUP/yr × 1.16E-02 lb/ADTP × 1 ton/2,000 lb = 3.9 tons/yr

C.6.2 Carbon Monoxide (CO) Emissions

Emission factor from NCASI TB 884 = 0.045 lb/ADTP

Baseline actual emissions:

1,675 ADTUP/day × 0.045 lb/ADTP × 1 day/24 hr = 3.1 lbs/hr

610,000 ADTUP/yr × 0.045 lb/ADTP × 1 ton/2,000 lb = 14 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.045 lb/ADTP × 1 day/24 hr = 3.4 lbs/hr

666,125 ADTUP/yr × 0.045 lb/ADTP × 1 ton/2,000 lb = 15 tons/yr

C.6.3 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884= 0.20 lb/ADTP

Control efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 0.20 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.28 lb/hr

610,000 ADTUP/yr × 0.20 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 1.2 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.20 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 0.30 lb/hr

666,125 ADTUP/yr × 0.20 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 1.3 tons/yr

C.6.4 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858 = 0.98 lb/ADTP

Control efficiency = 98%

Baseline actual emissions:

1,675 ADTUP/day × 0.98 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 1.4 lbs/hr

610,000 ADTUP/yr × 0.98 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 6.0 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.98 lb/ADTP × 1 day/24 hr × (1 - 0.98) = 1.5 lbs/hr

666,125 ADTUP/yr × 0.98 lb/ADTP × 1 ton/2,000 lb × (1 - 0.98) = 6.5 tons/yr

APPENDIX D

Emissions Calculations

Kraft Bleaching System

D.1 Kraft Mill ECF Bleaching System

Baseline actual unbleached kraft production = current maximum unbleached kraft production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Baseline actual bleached kraft production = current maximum bleached kraft production = 1,575 ADTBP/day and 575,000 ADTBP/yr

Projected actual unbleached kraft production = future maximum unbleached kraft production = 1,825 ADTUP/day and 666,125 ADTUP/yr

Projected actual bleached kraft production = future maximum bleached kraft production = 1,752 ADTBP/day and 639,480 ADTBP/yr

D.1.1 Carbon Monoxide (CO) Emissions

Emission factor from NCASI TB 884 = [0.18 × percent ClO_2 applied] + 0.45 lb/ODTUP

Percent ClO_2 applied = 49 lb/ton ÷ 2,000 lb/ton × 100 = 2.45

Emission factor = [0.18 × 2.45] + 0.45 = 0.891 lb/ODTUP × 0.9 ODT/ADT = 0.802 lb/ADTUP

Baseline actual emissions:

1,675 ADTUP/day × 0.802 lb/ADTUP × 1 day/24 hr = 56.0 lbs/hr

610,000 ADTUP/yr × 0.802 lb/ADTUP × 1 ton/2,000 lb = 245 tons/yr

Projected actual emissions:

1,825 ADTUP/day × 0.802 lb/ADTUP × 1 day/24 hr = 61.0 lbs/hr

666,125 ADTUP/yr × 0.802 lb/ADTUP × 1 ton/2,000 lb = 267 tons/yr

D.1.2 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884 = 0.050 lb/ODTUP

Emission factor = 0.050 lb/ODTUP × 0.9 ODT/ADT = 0.045 lb/ADTUP

Baseline actual emissions:

1,675 ADTBP/day × 0.045 lb/ADTP × 1 day/24 hr = 3.1 lbs/hr

610,000 ADTBP/yr × 0.045 lb/ADTP × 1 ton/2,000 lb = 14 tons/yr

Projected actual emissions:

1,825 ADTBP/day × 0.045 lb/ADTP × 1 day/24 hr = 3.4 lbs/hr

666,125 ADTBP/yr × 0.045 lb/ADTP × 1 ton/2,000 lb = 15 tons/yr

D.1.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from NCASI TB 858 = 0.13 lb/ADTBP

Baseline actual emissions:

1,575 ADTBP/day × 0.13 lb/ADTBP × 1 day/24 hr = 8.5 lbs/hr

575,000 ADTBP/yr × 0.13 lb/ADTBP × 1 ton/2,000 lb = 37 tons/yr

Projected actual emissions:

1,752 ADTBP/day × 0.13 lb/ADTBP × 1 day/24 hr = 9.5 lbs/hr

639,480 ADTBP/yr × 0.13 lb/ADTBP × 1 ton/2,000 lb = 42 tons/yr

D.1.4 Total Reduced Sulfur (TRS) Emissions

Emission factors from NCASI TB 858 for total TRS (as S) = 2.8E-03 lb/ADTBP

Baseline actual emissions:

1,575 ADTBP/day × 2.8E-03 lb/ADTBP × 1 day/24 hr = 0.18 lb/hr

575,000 ADTBP/yr × 2.8E-03 lb/ADTBP × 1 ton/2,000 lb = 0.81 ton/yr

Projected actual emissions:

1,752 ADTBP/day × 2.8E-03 lb/ADTBP × 1 day/24 hr = 0.20 lb/hr

639,480 ADTBP/yr × 2.8E-03 lb/ADTBP × 1 ton/2,000 lb = 0.90 ton/yr

APPENDIX E

Emissions Calculations

Kraft Evaporator Set No. 1

68% Black Liquor Storage Tank

E.1 Kraft Mill Evaporator Set No. 1

Evaporator Set No. 1 production = 28% of current total evaporator capacity

Baseline actual kraft production = current maximum production = 1,675 ADTUP/day and 610,000 ADTUP/yr

Evaporator Set No. 1 actual production = 1,675 ADTUP/day × 0.28 = 470 ADTUP/day

Projected actual kraft production = 1,825 ADTUP/day and 666,125 ADTUP/yr

Evaporator Set No. 1 future production = 470 ADTUP + (1,825 ADTUP/day – 1,675 ADTUP/day)
= 620 ADTUP/day

E.1.1 Sulfur Dioxide (SO_2) Emissions

Emission factor from 2001 PSD permit application = 3.28 lb/ADTUP (September 1996 stack test)

LVHC caustic scrubber removal efficiency = 50%

Emission factor = 3.28 lb/ADTUP × (1 – 0.50) = 1.64 lb SO_2/ADTUP

Baseline actual emissions:

470 ADTUP/day × 1.64 lb/ADTUP × 1 day/24 hr = 32.1 lbs/hr

32.1 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 141 tons/yr

Projected actual emissions:

620 ADTUP/day × 1.64 lb/ADTUP × 1 day/24 hr = 42.4 lbs/hr

42.4 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 186 tons/yr

E.1.2 Volatile Organic Compound (VOC) Emissions

Emission factor from 2001 PSD permit application = 0.49 lb/ADTUP (September 1996 stack test)

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

470 ADTUP/day × 0.49 lb/ADTUP × (1 - 0.98) × 1 day/24 hr = 0.19 lb/hr

0.19 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.83 tons/yr

Projected actual emissions:

620 ADTUP/day × 0.49 lb/ADTUP × (1 - 0.98) × 1 day/24 hr = 0.25 lb/hr

0.25 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.1 tons/yr

E.1.3 Hazardous Air Pollutant (Methanol) Emissions

Emission factor from 2001 PSD permit application = 0.49 lb/ADTUP (September 1996 stack test)

Combination boiler destruction efficiency = 98%

Baseline actual emissions:

470 ADTUP/day × 0.49 lb/ADTUP × (1 - 0.98) × 1 day/24 hr = 0.19 lb/hr

0.19 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.83 tons/yr

Projected actual emissions:

620 ADTUP/day × 0.49 lb/ADTUP × (1 - 0.98) × 1 day/24 hr = 0.25 lb/hr

0.25 lbs/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.1 tons/yr

E.2 New 68% Black Liquor Storage Tank

New 68% (heavy/strong) black liquor storage tank

E.2.1 Volatile Organic Compound (VOC) Emissions (Method 25/25A as C)

Emission factor from NCASI TB 884 = 0.11 lb/hr/tank

Potential emissions:

1 tank × 0.11 lb//hr/tank = 0.11 lbs/hr

0.11 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.48 tons/yr

E.2.2 Total Reduced Sulfur (TRS) Emissions (as H_2S)

Emission factor from NCASI TB 849 = 0.18 lb/hr/tank

Potential emissions:

1 tank × 0.18 lb//hr/tank = 0.18 lbs/hr

0.18 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.79 tons/yr

APPENDIX F

Emissions Calculations

No. 3 Recovery Furnace

No. 3 Smelt Dissolving Tank

No. 3 Precipitator Mix Tank

F.1 No. 3 Recovery Furnace

Baseline actual production = current maximum production = 1,774 TBLS/day and 647,500 TBLS/yr

Projected actual production = future maximum production = 2,040 TBLS/day and 744,600 TBLS/yr

F.1.1 Particulate Matter (PM/PM_{10}) Emissions

NCASI TB 884 emission factors = 0.37 lb/TBLS (filterable)

= 0.063 lb/TBLS (condensable)

December 2, 2003 compliance test = 29.4 lb/hr × hr/73.5 TBLS = 0.40 lb/TBLS (filterable)

August 4, 2004 compliance test = 23 lb/hr × hr/68 TBLS = 0.34 lb/TBLS (filterable)

February 15, 2005 engineering test = 48.7 lb/hr × hr/66.3 TBLS = 0.73 lb/TBLS (filterable)

February 16, 2005 engineering test = 45.4 lb/hr × hr/69.7 TBLS = 0.65 lb/TBLS (filterable)

Average test value = [0.40 + 0.34 + 0.73 + 0.65] ÷ 4 = 0.53 lb/TBLS (filterable)

PM_{10} Emission factor = 0.53 + 0.063 = 0.593 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.593 lb/TBLS × 1 day/24 hr = 43.8 lb/hr

43.8 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 192 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.593 lb/TBLS × 1 day/24 hr = 50.4 lb/hr

50.4 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 221 tons/yr

F.1.2 Sulfur Dioxide (SO_2) Emissions

NCASI TB 884 emission factor = 0.22 lb/TBLS

December 2, 2003 compliance test = 17.7 lb/hr × hr/73.5 TBLS = 0.24 lb/TBLS

August 4, 2004 compliance test = 2.1 lb/hr × hr/68 TBLS = 0.031 lb/TBLS

Average test value = [0.24 + 0.031] ÷ 2 = 0.14 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.22 lb/TBLS × 1 day/24 hr = 16.3 lb/hr

16.3 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 71 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.22 lb/TBLS × 1 day/24 hr = 18.7 lb/hr

18.7 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 82 tons/yr

F.1.3 Nitrogen Oxide (NO_X) Emissions

NCASI TB 884 emission factor = 1.50 lb/TBLS

December 2, 2003 compliance test = 108.5 lb/hr × hr/73.5 TBLS = 1.48 lb/TBLS

August 4, 2004 compliance test = 86.7 lb/hr × hr/68 TBLS = 1.28 lb/TBLS

Average test value = [1.48 + 1.28] ÷ 2 = 1.38 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 1.50 lb/TBLS × 1 day/24 hr = 111 lb/hr

111 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 486 tons/yr

Projected actual emissions:

2,040 TBLS/day × 1.50 lb/TBLS × 1 day/24 hr = 128 lb/hr

128 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 561 tons/yr

F.1.4 Carbon Monoxide (CO) Emissions

NCASI TB 884 emission factor = 1.21 lb/TBLS

December 2, 2003 compliance test = 65.2 lb/hr × hr/73.5 TBLS = 0.89 lb/TBLS

August 4, 2004 compliance test = 109 lb/hr × hr/68 TBLS = 1.60 lb/TBLS

Average test value = [0.89 + 1.60] ÷ 2 = 1.25 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 1.25 lb/TBLS × 1 day/24 hr = 92.4 lb/hr

92.4 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 405 tons/yr

Projected actual emissions:

2,040 TBLS/day × 1.25 lb/TBLS × 1 day/24 hr = 106 lb/hr

106 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 464 tons/yr

F.1.5 Volatile Organic Compound (VOC) Emissions (Method 25/25A as C)

Emission factor from NCASI TB 884 = 0.09 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.09 lb/TBLS × 1 day/24 hr = 6.7 lb/hr

6.7 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 29 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.09 lb/TBLS × 1 day/24 hr = 7.7 lb/hr

7.7 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 34 tons/yr

F.1.6 Total Reduced Sulfur (TRS) Emissions (as H_2S)

NCASI TB 849 emission factor (as S) = 0.018 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.018 lb/TBLS × 1 day/24 hr × 34/32 = 1.4 lb/hr

1.4 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 6.1 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.018 lb/TBLS × 1 day/24 hr × 34/32 = 1.6 lb/hr

1.6 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 7.0 tons/yr

F.2 No. 3 Smelt Dissolving Tank

Baseline actual production = current maximum production = 1,774 TBLS/day and 647,500 TBLS/yr

Projected actual production = future maximum production = 2,040 TBLS/day and 744,600 TBLS/yr

F.2.1 Particulate Matter (PM/PM_{10}) Emissions

NCASI TB 884 emission factor = 0.15 lb/TBLS (filterable + condensable)

April 20, 2004 compliance test = 0.10 lb/TBLS (filterable)

Baseline actual emissions:

1,774 TBLS/day × 0.15 lb/TBLS × 1 day/24 hr = 11.1 lb/hr

11.1 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 49 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.15 lb/TBLS × 1 day/24 hr = 12.8 lb/hr

12.8 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 56 tons/yr

F.2.2 Sulfur Dioxide (SO_2) Emissions

NCASI TB 884 emission factor = 0.005 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.005 lb/TBLS × 1 day/24 hr = 0.37 lb/hr

0.37 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.6 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.005 lb/TBLS × 1 day/24 hr = 0.43 lb/hr

0.43 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.9 tons/yr

F.2.3 Nitrogen Oxide (NO_X) Emissions

Emission factor from NCASI TB 884 = 0.020 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.020 lb/TBLS × 1 day/24 hr = 1.5 lb/hr

1.5 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 6.6 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.020 lb/TBLS × 1 day/24 hr = 1.7 lb/hr

1.7 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 7.4 tons/yr

F.2.4 Volatile Organic Compound (VOC) Emissions (Method 25/25A as C)

Emission factor from NCASI TB 884 = 0.010 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.010 lb/TBLS × 1 day/24 hr = 0.74 lb/hr

0.74 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 3.2 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.010 lb/TBLS × 1 day/24 hr = 0.85 lb/hr

0.85 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 3.7 tons/yr

F.2.5 Total Reduced Sulfur (TRS) Emissions (as H_2S)

NCASI TB 849 emission factor (as S) = 0.012 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.012 lb/TBLS × 1 day/24 hr × 34/32 = 0.94 lb/hr

0.94 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 4.1 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.012 lb/TBLS × 1 day/24 hr × 34/32 = 1.0 lb/hr

1.0 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 4.4 tons/yr

F.3 No. 3 Precipitator Mix Tank

Baseline actual production = current maximum production = 1,774 TBLS/day and 647,500 TBLS/yr

Projected actual production = future maximum production = 2,040 TBLS/day and 744,600 TBLS/yr

F.3.1 Volatile Organic Compound (VOC) Emissions

Emission factor from NCASI TB 884 = 0.0013 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.0013 lb/TBLS × 1 day/24 hr = 0.096 lb/hr

0.096 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.42 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.0013 lb/TBLS × 1 day/24 hr = 0.11 lb/hr

0.11 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.48 tons/yr

F.3.2 Total Reduced Sulfur (TRS) Emissions (as H_2S)

NCASI TB 849 emission factor (as S) = 0.00010 lb/TBLS

Baseline actual emissions:

1,774 TBLS/day × 0.00010 lb/TBLS × 1 day/24 hr × 34/32 = 0.0079 lb/hr

0.0079 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.035 tons/yr

Projected actual emissions:

2,040 TBLS/day × 0.00010 lb/TBLS × 1 day/24 hr × 34/32 = 0.0085 lb/hr

0.0085 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.037 tons/yr

APPENDIX G

Emissions Calculations

Causticizing Area

No. 2 Lime Kiln

G.1 Causticizing Area

Baseline actual production = current maximum production = 465 tons CaO/day and 170,000 tons CaO/yr

Projected actual production = future maximum production = 600 tons CaO/day and 219,000 tons CaO/yr

G.1.1 Particulate Matter (PM/PM_{10}) Emissions

G.1.1.1Fresh Lime Storage Silo:

Average fresh lime make-up = 125 lb CaO/ton CaO

Actual fresh lime make-up = 125 lb CaO/ton CaO × 170,000 ton CaO/yr × 1 ton/2,000 lb
= 10,625 tons CaO

Future fresh lime make-up = 125 lb CaO/ton CaO × 219,000 ton CaO/yr × 1 ton/2,000 lb
= 13,688 tons CaO

Truck delivery capacity = 30 tons

Time to unload truck = 2 hours

Use one-half of emission factor from 1994 permit application = 0.02 gr/acf ÷ 2 = 0.01 gr/acf

Use flow rate from 1994 permit application = 3,835 acfm

Baseline actual emissions:

0.01 gr/acf × 3,835 acf/min × 60 min/hr × 1 lb/7,000 gr = 0.33 lb/hr

0.33 lb/hr × 10,625 tons CaO/yr × 2 hr/30 tons CaO × 1 ton/2,000 lb = 0.12 tons/yr

Projected actual emissions:

0.01 gr/acf × 3,835 acf/min × 60 min/hr × 1 lb/7,000 gr = 0.33 lb/hr

0.33 lb/hr × 13,688 ton CaO/yr × 2 hr/30 ton CaO × 1 ton/2,000 lb = 0.15 tons/yr

G.1.1.2Slaker:

Emission factor from NCASI TB 884 = 0.022 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.022 lb/ton CaO × 1 day/24 hr = 0.43 lb/hr

0.43 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.9 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.022 lb/TBLS × 1 day/24 hr = 0.55 lb/hr

0.55 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 2.4 tons/yr

G.1.1.3 Total PM/PM_{10} emissions:

Baseline actual emissions:

0.12 tons/yr + 1.9 tons/yr = 2.0 tons/yr

Projected actual emissions:

0.15 tons/yr + 2.4 tons/yr = 2.6 tons/yr

G.1.2 Volatile Organic Compound (VOC) Emissions

Emission factors from NCASI TB 884:

Slaker and Causticizers =	5.70E-2
Lime Mud Precoat Filters =	4.1E-3
Precoat Filter Vacuum Pumps =	1.8E-2
Green Liquor Clarifier =	6.6E-2
Green Liquor Surge Tank =	1.4E-3
Weak Wash Pressure Filter =	7.5E-3
White Liquor Pressure Filter =	5.6E-3
Total Causticizing Area =	1.6E-1 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.16 lb/ton CaO ×1 day/24 hr = 3.1 lb/hr

3.1 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 14 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.16 lb/ton CaO ×1 day/24 hr = 4.0 lb/hr

4.0 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 18 tons/yr

G.1.3 Total Reduced Sulfur (TRS) Emissions

Emission factors from NCASI TB 849:

Slaker and Causticizers = 1.2E-3

Emission factors from NCASI TB 701:

Lime Mud Precoat Filters = 5.0E-4

Precoat Filter Vacuum Pumps = 1.1E-3

Green Liquor Clarifier = 6.2E-4

Green Liquor Surge Tank = 8.1E-5

Weak Wash Pressure Filter = 0

White Liquor Pressure Filter = 0

Total Causticizing Area = 3.5E-3 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 3.5 E-3 lb/ton CaO × 1 day/24 hr = 0.068 lb/hr

0.068 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.30 tons/yr

Projected actual emissions:

600 ton CaO/day × 3.5 E-3 lb/ton CaO × 1 day/24 hr = 0.088 lb/hr

0.088 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 0.39 tons/yr

G.2 No. 2 Lime Kiln

Baseline actual production = current maximum production = 465 tons CaO/day and 170,000 tons CaO/yr

Projected actual production = future maximum production = 600 tons CaO/day and 219,000 tons CaO/yr

G.2.1 Particulate Matter (PM) Emissions

NCASI TB 884 emission factor = 0.089 lb/ton CaO (filterable)

= 0.188 lb/ton CaO (condensable)

December 2, 2003 compliance test = 2.1 lb/hr × hr/17 ton CaO = 0.12 lb/ton CaO (filterable)

August 4, 2004 compliance test = 2.1 lb/hr × hr/16.6 ton CaO = 0.13 lb/ton CaO (filterable)

Average test value = [0.12 + 0.13] ÷ 2 = 0.125 lb/ton CaO (filterable)

PM_{10} Emission factor = 0.125 + 0.188 = 0.313 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.313 lb/ton CaO × 1 day/24 hr = 6.1 lb/hr

6.1 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 27 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.313 lb/ton CaO × 1 day/24 hr = 7.8 lb/hr

7.8 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 34 tons/yr

G.2.2 Sulfur Dioxide (SO_2) Emissions

NCASI TB 884 emission factor = 0.33 lb/ton CaO

December 2, 2003 compliance test = 0.33 lb/hr × hr/17 ton CaO = 0.019 lb/ton CaO

August 4, 2004 compliance test = 0.28 lb/hr × hr/16.6 ton CaO = 0.017 lb/ton CaO

Average test value = [0.019 + 0.017] ÷ 2 = 0.018 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.33 lb/ton CaO × 1 day/24 hr = 6.4 lb/hr

6.4 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 28 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.33 lb/ton CaO × 1 day/24 hr = 8.3 lb/hr

8.3 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 36 tons/yr

G.2.3 Nitrogen Oxide (NO_X) Emissions

NCASI TB 884 emission factor = 1.15 lb/ton CaO

December 2, 2003 compliance test = 47.1 lb/hr × hr/17 ton CaO = 2.77 lb/ton CaO

August 4, 2004 compliance test = 24.4 lb/hr × hr/16.6 ton CaO = 1.47 lb/ton CaO

Average test value = [2.77 + 1.47] ÷ 2 = 2.12 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 2.12 lb/ton CaO × 1 day/24 hr = 41 lb/hr

41 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 180 tons/yr

Projected actual emissions:

600 ton CaO/day × 2.12 lb/ton CaO × 1 day/24 hr = 53 lb/hr

53 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 232 tons/yr

G.2.4 Carbon Monoxide (CO) Emissions

NCASI TB 884 emission factor = 0.055 lb/ton CaO

December 2, 2003 compliance test = 2.8 lb/hr × hr/17 ton CaO = 0.165 lb/ton CaO

August 4, 2004 compliance test = 1.5 lb/hr × hr/16.6 ton CaO = 0.090 lb/ton CaO

Average test value = [0.165 + 0.090] ÷ 2 = 0.128 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.128 lb/ton CaO × 1 day/24 hr = 2.5 lb/hr

2.5 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 11 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.128 lb/ton CaO × 1 day/24 hr = 3.2 lb/hr

3.2 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 14 tons/yr

G.2.5 Volatile Organic Compound (VOC) Emissions (Method 25/25A as C)

NCASI TB 884 emission factor = 0.023 lb/ton CaO

Baseline actual emissions:

465 ton CaO/day × 0.023 lb/ton CaO × 1 day/24 hr = 0.45 lb/hr

0.45 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 2.0 tons/yr

Projected actual emissions:

600 ton CaO/day × 0.023 lb/ton CaO × 1 day/24 hr = 0.58 lb/hr

0.58 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 2.5 tons/yr

G.2.6 Total Reduced Sulfur (TRS) Emissions (as H_2S)

NCASI TB 849 emission factor (as S) = 0.059 lb/ton CaO

Baseline actual emissions:

465 ton CaO /day × 0.059 lb/ ton CaO × 1 day/24 hr × 34/32 = 1.2 lb/hr

1.2 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 5.3 tons/yr

Projected actual emissions:

600 ton CaO /day × 0.059 lb/ ton CaO × 1 day/24 hr × 34/32 = 1.6 lb/hr

1.6 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 7.0 tons/yr

APPENDIX H

Emissions Calculations

Woodyard Truck Dumper

H.1 New Woodyard Truck Dumper

Capacity of new truck dumper = 1 truck every 15 minutes

Capacity of 1 truck = 30 tons wood chips

H.1.1 Particulate Matter (PM) Emissions

Emission factor from Florida Pulp and Paper Association (1994) = 0.5 lb/ton chips

Percent fines in purchased chips = 0.2% (FP&P 1994)

Process variability factor = 2 (FP&P 1994)

Potential emissions:

1 truck/15 min × 60 min/hr × 30 tons chips/truck × 0.5 lb/ton chips × 0.002 × 2 = 0.24 lb/hr

0.24 lb/hr × 8,760 hr/yr × 1 ton/2,000 lb = 1.1 tons/yr

APPENDIX I

BACT Cost Spreadsheets

EVALUATION OF CONTROL COST IMPACTS FOR RECOVERY FURNACE NO. 3
BOWATER
CATAWBA, SOUTH CAROLINA

Control System	SO_2 Loading (tpy) (a)	SO_2 Outlet (tpy)	Percent Reduction (b)	PM Emissions Reduction (c) (tpy)	Economic Impacts	
					Total Annualized Cost (d)	
				Actual	($/yr)	($/ton)
SO_2 Scrubber (90%)	82	8	90.00%	73.8	$ 3,459,703	$ 46,879
SO_2 Scrubber (90%)	556	55.6	90.00%	500.4	$ 3,459,703	$ 6,914

ANNUALIZED COST ANALYSIS

BOWATER
CATAWBA, SOUTH CAROLINA
RECOVERY FURNACE NO. 3

SO_2 SCRUBBER

Cost Item	Computation Method	Cost (Dollars) SCRUBBER
Direct Costs		
Purchased Equipment:		
Total Basic Equipment (A)	Vendor Information	$4,000,000
Purchased Equipment Cost (B)	Subtotal of above	$4,000,000
Direct Installation Costs (DIC)	Air Pollution Cost Control Manual - 6th Edition	$2,240,000
Modifications to ductwork	Air Pollution Cost Control Manual - 6th Edition	$80,000
Total Direct Costs (DC)	Subtotal of above	$6,320,000
Indirect Costs (IC)	Air Pollution Cost Control Manual - 6th Edition	$1,400,000
TOTAL CAPITAL INVESTMENT (E)	VENDOR INFORMATION	**$7,720,000**
Pulp Production Losses	25% x $1167/ton pulp x 1005 ADTP/day x 5 days (1)	$1,468,000
TOTAL CAPITAL INVESTMENT + PULP PRODUCTION LOSSES		**$9,188,000**
Direct Operating Costs		
Operator	20.00 $/hr x 3,285 hr/yr	$131,400
Supervisory Labor	15% of operator labor cost	$39,420
Operating Materials	As Required	
Maintenance (general)		
Labor	20.00 $/hr x 1,095 hr/yr	$42,541
Materials	100% of maintenance labor cost	$42,541
Utilities	Vendor Estimates	
Electricity	0.07 $/kWh x 2,668,464 kWh/yr	$ 186,792
Water	0.20 $/1000 gal x 64,411 1000 gal/yr	$ 12,882
Caustic	300.00 $/2000 lb x 2,803 1000 lb/yr	$ 840,960
Waste Disposal	$/ton x ton/yr	$ -
Wastewater Treatment	3.8 $/1000 gal x 129,696 1000 gal/yr	$ 492,845
TOTAL DIRECT COSTS (A)	Subtotal of above	**$1,789,381**

RECOVERY FURNACE NO. 3 SCRUBBER (CONT)
BOWATER
ANNUALIZED COST ANALYSIS

Cost Item	Computation Method	Cost (Dollars) SCRUBBER
Indirect Operating Costs		
Overhead	60% of O/M labor costs (a+b)	$153,541
Property Tax	1% of capital costs (G)	$77,200
Insurance	1% of capital costs (G)	$77,200
Administration	2% of capital costs (G)	$154,400
Capital Recovery	CRF = i (1+ i) ^ n / ((1+i)^ n-1) ; i= interest rate , n= years	0.1315
	(10% for 15 yr) x (capital costs + pulp production losses)	$1,207,981
TOTAL FIXED COSTS (B)	Subtotal of above	**$1,670,322**
TOTAL ANNUALIZED COSTS (D)	**(A+B)**	**$3,459,703**

EVALUATION OF CONTROL COST IMPACTS FOR RECOVERY FURNACE NO. 3
BOWATER
CATAWBA, SOUTH CAROLINA

Control System	PM Loading (tpy) (a)	PM Outlet (tpy)	Percent Reduction (b)	PM Emissions Reduction (c) (tpy)	PM Emissions Change (tpy)	Economic Impacts		
						Total Annualized Cost (d)	Difference between existing and modified ESP	
				Actual		($/yr)	($/yr)	($/ton)
Existing ESP (0.036 gr/dscf)	66670	342	99.49%	66328.2	0.0	$ 1,805,678	N/A	N/A
Modified ESP (0.03 gr/dscf)	66670	285	99.57%	66385.2	57.0	$ 3,745,287	$ 1,939,609	**$ 34,022.70**
Modified ESP (0.027 gr/dscf)	66670	257	99.62%	66413.7	85.5	$ 3,796,448	$ 1,990,770	**$ 23,280.08**
Modified ESP (0.025 gr/dscf)	66670	238	99.64%	66432.7	104.5	$ 3,829,029	$ 2,023,350	**$ 19,359.06**
Modified ESP (0.023 gr/dscf)	66670	219	99.67%	66451.7	123.5	$ 3,892,577	$ 2,086,899	**$ 16,895.22**
Modified ESP (0.021 gr/dscf)	66670	200	99.70%	66470.7	142.5	$ 3,951,279	$ 2,145,600	**$ 15,054.40**

ANNUALIZED COST ANALYSIS

BOWATER
CATAWBA, SOUTH CAROLINA

New DRY FLAT PLATE ESP COST USING ACA MODEL

Cost Item	Computation Method	Cost (Dollars) Existing ESP (0.036 gr/dscf)	Cost (Dollars) New ESP (0.030 gr/dscf)	Cost (Dollars) New ESP (0.027 gr/dscf)	Cost (Dollars) New ESP (0.025 gr/dscf)	Cost (Dollars) New ESP (0.023 gr/dscf)	Cost (Dollars) New ESP (0.021 gr/dscf)
Direct Costs							
Purchased Equipment:							
Total Basic Equipment (A)	ACA Model	$0	$2,272,501	$2,366,648	$2,426,530	$2,543,174	$2,650,741
Purchased Equipment Cost (B)	ACA Model	$0	$2,681,551	$2,792,645	$2,863,305	$3,000,946	$3,127,874
Direct Installation Costs (DIC)	ACA Model	$0	$1,796,639	$1,871,072	$1,918,414	$2,010,634	$2,095,676
Total Direct Costs (DC)	ACA Model	$0	$4,478,190	$4,663,717	$4,781,720	$5,011,579	$5,223,550
Indirect Costs (IC)	ACA Model	$0	$1,528,484	$1,591,808	$1,632,084	$1,710,539	$1,782,888
TOTAL CAPITAL INVESTMENT (E)	ACA Model	**$0**	**$6,006,674**	**$6,255,525**	**$6,413,803**	**$6,722,118**	**$7,006,438**
Pulp Production Losses	25% x $1,167/ton pulp x 1005 ADTP/day x 25 days (1)	$0	$7,336,000	$7,336,000	$7,336,000	$7,336,000	$7,336,000
TOTAL CAPITAL INVESTMENT + PULP PRODUCTION LOSSES		**$0**	**$13,342,674**	**$13,591,525**	**$13,749,803**	**$14,058,118**	**$14,342,438**

(1) Calculation shown is used to determine pulp production losses for shutdown of the recovery boiler and installation of a scrubber. Daily pulp production rate based on data provided by plant.
Plant estimates 30 days of downtime for recovery boiler shutdown, scrubber installation, and boiler startup; therefore, production losses will be assumed for 25 days beyond the scheduled 5 days of shutdown semi-annually.
Escalated market value of pulp and earnings margin of 25% are based on estimates in Section 6.1.1.1 of U.S. EPA's Technical Support Document for
Chemical Recovery Combustion Sources at Kraft and Soda Pulp Mills.

RECOVERY FURNACE NO. 3 ESP (CONT)
BOWATER
ANNUALIZED COST ANALYSIS

Cost Item	Computation Method	Cost (Dollars) Existing ESP (0.036 gr/dscf)	Cost (Dollars) New ESP (0.030 gr/dscf)	Cost (Dollars) New ESP (0.027 gr/dscf)	Cost (Dollars) New ESP (0.025 gr/dscf)	Cost (Dollars) New ESP (0.023 gr/dscf)	Cost (Dollars) New ESP (0.021 gr/dscf)
Direct Operating Costs							
Operator	12.94 $/hr x 1,643 hr/yr (2)	$21,255 (a)	$21,255 (a)	$21,255 (a)	$21,255 (a)	$21,255 (a)	$21,255 (a)
Supervisory Labor	15% of operator labor cost	$3,188 (a)	$3,188 (a)	$3,188 (a)	$3,188 (a)	$3,188 (a)	$3,188 (a)
Coordinator Labor	33% of operator labor cost	$7,085	$7,085	$7,085	$7,085	$7,085	$7,085
Operating Materials	As Required						
Maintenance (general)							
Labor	ACA Model	$16,957	$18,060	$18,951	$19,521	$20,639	$21,678
Materials	ACA Model	$25,428	$26,816	$27,926	$28,633	$30,009	$31,279
Replacement Parts	none (3)	$0	$0	$0	$0	$0	$0
Electricity	ACA Model	$179,328	$190,192	$198,966	$204,581	$215,592	$225,830
Utilities	ACA Model	$179,328	$190,192	$198,966	$204,581	$215,592	$225,830
TOTAL DIRECT COSTS (A)	ACA Model	**$253,242**	**$266,596**	**$277,373**	**$284,264**	**$297,770**	**$310,316**

RECOVERY FURNACE NO. 3 ELECTROSTATIC PRECIPITATOR (CONT)
BOWATER
ANNUALIZED COST ANALYSIS

Cost Item	Computation Method	Cost (Dollars) Existing ESP (0.036 gr/dscf)	Cost (Dollars) New ESP (0.030 gr/dscf)	Cost (Dollars) New ESP (0.027 gr/dscf)	Cost (Dollars) New ESP (0.025 gr/dscf)	Cost (Dollars) New ESP (0.023 gr/dscf)	Cost (Dollars) New ESP (0.021 gr/dscf)
Indirect Operating Costs							
Overhead	60% of O/M labor costs (a+b)	$44,348	$45,843	$47,044	$47,810	$49,306	$50,692
Property Tax	1% of capital costs (G)	$56,959	$60,067	$62,555	$64,138	$67,221	$70,064
Insurance	1% of capital costs (G)	$56,959	$60,067	$62,555	$64,138	$67,221	$70,064
Administration	2% of capital costs (G)	$113,917	$120,133	$125,110	$128,276	$134,442	$140,129
Capital Recovery	CRF	0.1175	0.1175	0.1175	0.1175	0.1175	0.1175
	(10% for 20 yr) x (capital costs + pulp production losses)	$0	$1,912,328	$1,941,558	$1,960,149	$1,996,364	$2,029,760
TOTAL FIXED COSTS (B)	Subtotal of above	**$272,183**	**$2,198,438**	**$2,238,822**	**$2,264,511**	**$2,314,554**	**$2,360,709**
TOTAL CREDITS (minus C)	ACA Model	**($1,280,253)**	**($1,280,253)**	**($1,280,253)**	**($1,280,253)**	**($1,280,253)**	**($1,280,253)**
TOTAL ANNUALIZED COSTS (D)	**(A+B) - C**	**$1,805,678**	**$3,745,287**	**$3,796,448**	**$3,829,029**	**$3,892,577**	**$3,951,279**

EVALUATION OF CONTROL COST IMPACTS FOR NO. 2 LIME KILN
BOWATER
CATAWBA, SOUTH CAROLINA

Control System	SO_2 Loading (tpy) (a)	SO_2 Outlet (tpy)	Percent Reduction (b)	PM Emissions Reduction (c) (tpy)	Economic Impacts: Total Annualized Cost (d) ($/yr)	($/ton)
				Actual		
SO_2 Scrubber	34	3	90.00%	30.6	$ 1,960,818	$ 64,079
SO_2 Scrubber	173	17	90.00%	155.7	$ 1,960,818	$ 12,594

ANNUALIZED COST ANALYSIS

BOWATER
CATAWBA, SOUTH CAROLINA
NO. 2 LIME KILN
SO_2 PACKED COLUMN SCUBBER

Cost Item	Computation Method	Cost (Dollars) SCRUBBER
Direct Costs		
Purchased Equipment:		
Total Basic Equipment (A)	Vendor Information	$3,000,000
Purchased Equipment Cost (B)	Subtotal of above	$3,000,000
Direct Installation Costs (DIC)	Air Pollution Cost Control Manual - 6th Edition	$1,680,000
Modifications to ductwork	Air Pollution Cost Control Manual - 6th Edition	$60,000
Total Direct Costs (DC)	Subtotal of above	$4,740,000
Indirect Costs (IC)	Air Pollution Cost Control Manual - 6th Edition	$1,050,000
TOTAL CAPITAL INVESTMENT (E)	VENDOR INFORMATION	**$5,790,000**
Pulp Production Losses	25% x $1,167/ton pulp x 1,005 ADTP/day x 0 days (1)	$0
TOTAL CAPITAL INVESTMENT + PULP PRODUCTION LOSSES		**$5,790,000**
Direct Operating Costs		
Operator	20.00 $/hr x 3,285 hr/yr	$131,400 (a)
Supervisory Labor	15% of operator labor cost	$39,420 (a)
Operating Materials	As Required	
Maintenance (general)		
Labor	20.00 $/hr x 1,095 hr/yr	$42,541
Materials	100% of maintenance labor cost	$42,541
Utilities	Vendor Estimates	
Electricity	0.06 $/kWh x 596,959 kWh/yr	$ 35,221
Water	0.20 $/1000 gal x 14,409 1000 gal/yr	$ 2,882
Caustic	300.00 $/2000 lb x 1,512 1000 lb/yr	$ 453,514
Waste Disposal	20 $/ton x 755.8566 ton/yr	$ 15,117
Wastewater Treatment	3.8 $/1000 gal x 13,634 1000 gal/yr	$ 51,809
TOTAL DIRECT COSTS (A)	Subtotal of above	**$814,444**

NO. 2 LIME KILN SCRUBBER (CONT)
BOWATER
ANNUALIZED COST ANALYSIS

Cost Item	Computation Method	Cost (Dollars) SCRUBBER
Indirect Operating Costs		
Overhead	60% of O/M labor costs (a+b)	$153,541
Property Tax	1% of capital costs (G)	$57,900
Insurance	1% of capital costs (G)	$57,900
Administration	2% of capital costs (G)	$115,800
Capital Recovery	CRF = i (1+ i) ^ n / ((1+i)^ n-1) ; i= interest rate , n= years	0.1315
	(10% for 15 yr) x (capital costs + pulp production losses)	$761,233
TOTAL FIXED COSTS (B)	Subtotal of above	**$1,146,374**
TOTAL ANNUALIZED COSTS (D)	**(A+B)**	**$1,960,818**